UNIVERSITY OF LJUBLJANA
FACULTY OF ECONOMICS

MASTER THESIS

# BENEFITS AND BARRIERS OF SELF-SERVICE BUSINESS INTELLIGENCE IMPLEMENTATION IN MICRO-ENTERPRISES: A CASE OF ABC TRAVEL & CONSULTING

Ljubljana, November 2018 TOBIAS HARMS

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# LIST OF ABBREVIATIONS

| Abbreviation | Meaning |
|---|---|
| **ATM** | Automated teller machine |
| **BI** | Business intelligence |
| **BIS** | Business intelligence systems |
| **DBMS** | Database-management system |
| **ETL** | Extraction-Transformation-Loading |
| **IT** | Information technology |
| **OLAP** | Online analytical processing |
| **SSBI** | Self-service business intelligence |
| **SSBIS** | Self-service business intelligence solutions |
| **SST** | Self-service technologies |
| **SME** | Small medium enterprises |
| **SWOT** | Strengths, Weaknesses, Opportunities, Threats |
| **TOE** | Technology, Organization, Environment |
| **ME** | Micro-enterprises |
| **VOC** | Voice of Customer |

# INTRODUCTION

Small medium enterprises (hereinafter: SME) represent 99.8 % of firms in the non-financial business sector of the European Union. SME's cover three different types of companies, namely micro-, small- and medium-sized enterprises. Micro-enterprises are the most common type of SME in the European Economic Area, accounting for 93.2 % of the non-financial business sector (Muller, Julius, Herr & Peycheva, 2017). Due to their importance, the focus of this work will be on micro-enterprises. They are defined by two factors: firstly, the number of employees has to be lower than ten, and secondly, the turnover or the total assets must be lower than or equal to two million Euros (European Commission, 2014).

Business intelligence systems (hereinafter: BIS) have become significantly important in the business world and academic community over the last two decades (Chen, Chiang & Storey, 2012). The global revenue reached a volume of $ 18.3 billion in 2017 and is forecasted to reach $22.8 billion by the end of 2020. Modern BIS continue to expand more rapidly than the overall market (Moore, 2017). The benefits of the integration of BIS can be seen long-term, users are typically decision makers at higher organizational levels (Puklavec, Oliveira & Popovic, 2014). With the usage of BIS, knowledge workers such as executives, managers, and analysts can make better and faster decisions (Chaudhuri, Dayal & Narasayya, 2011). The proper usage of BIS can be seen as a prerequisite for business success, but these tools are often complex and require a high level of expertise to work with (Davenport, 2017). It is a challenge for micro companies to implement BIS because they have often only a limited set of financial and human resources (Puklavec, Oliveira & Popovic, 2014).

Modern business intelligence (hereinafter: BI) have solutions emerged in recent years, to meet new organizational requirements, accessibility, agility and deeper analytical insight, shifting to a business-led, agile analytics, including self-service (Moore, 2017). BIS has undergone two distinctly different fundamental changes. On the one hand, new data sources like social media systems, machine sensors and mobile devices appeared. They often differ from traditional operational data in terms of their structure, rate of growth and volume (McAfee & Brynjolfsson, 2012). On the other hand, the scope of BIS extended from a strategic oriented to more operational oriented tasks. Thus, more employees have the need to apply BI (Böhringer, Gluchowski, Kurze & Schieder, 2010). In addition, BI reports are requested to change more frequently (Yu, Lapouchnian & Deng, 2013). Consequently, more users, which are neither information technology (IT or BI professionals, are working with BIS (Kobielus, 2009).

Further to the recent development, the approach of self-service Business Intelligence solutions (hereinafter: SSBIS) has been suggested (Spahn, Kleb, Grimm & Scheidl, 2008); (Schlesinger & Rahman, 2016). Through the usage of SSBI users without a specific IT background shall be equipped to work with BIS (Curran & Meuter, 2005). It simplifies the access to source data in order to prosecute reporting and analytical tasks. Furthermore, it provides

improved data analysis and easy-to-use BI tools, fast-to-deploy and easy-to-manage data warehouse options, such as cloud computing and simpler and customizable end-user interfaces (Imhoff & White, 2011). The concept of self-service can be implemented for different tasks in BI: access to prepared reports or data resources, direct access to data, access to functions, or creation of new resources (Alpar & Schulz, 2016). When it comes to the implementation of BIS, relevant data of a high quality is needed. Getting the right data is one of the most challenging parts of BI. It is difficult to find the right data and to ensure the right data quality (Watson & Wixom, 2007). So far, research focused on traditional BIS and the adoption of it in SME's and large enterprises. There is a lack of in-depth research on the barriers and benefits of SSBS in micro companies (Olszak & Ziemba, 2012).

Micro-enterprises (hereinafter: ME) may be home-based, farm-based or street-front businesses and can be either part-time or full-time. They can be found everywhere: rural, urban, as well as in suburban areas in both developed and developing countries. ME are at the leading edge of the enterprise formation process (Wolcott, Kamal & Qureshi, 2008). To be successful in today's business world, it is essential for them to use BIS. By using BIS, companies can gain a marked advantage over competitors (Davenport, Harris & Morison, 2010). Due to the limited set of resources available to ME the implementation of a SSBIS can be a solution (Ranjan, 2009). Managing directors of micro companies often lack awareness of the benefits that information and communication technology (ICT) may provide to their business and have little or no training in this field (Duncombe & Heeks, 2003). Consequently, this is a major barrier to the adoption of new technologies. Since a lot of small companies are not using IT for their business activities, it is a big problem especially in micro companies (Barba-Sanchez, Martinez-Ruiz & Jimenez-Zarco, 2007).

The purpose of this thesis is to identify the benefits and barriers of self-service business intelligence implementation in micro-enterprises. In this dissertation the technology-organization-environment (hereinafter TOE) framework will be applied specifically for SSBIS solutions in micro companies. Therefore, relevant factors that decide the adoption of SSBIS in micro companies will be revealed. Further to this, an SSBI prototype for the company ABC Travel & Consulting will be developed. In-depth interviews with decision makers at the company will give a well-researched solution to the problems mentioned in this proposal.

The results of this study will help micro-enterprises to make a well-educated decision, as to whether they shall implement self-service business intelligence solutions, or not

This study will investigate the usage of SSBIS in micro companies, therefore there will be two main objectives in this study:

- Firstly, to determine the benefits which micro companies will gain through the implementation of SSBIS.
- Secondly, to show the main barriers, micro companies face if they want to implement

SSBIS.

The following goals can be derived from the main objectives:

- What differentiates SSBI from traditional BI?
    - To understand the differences of SSBI, first, a distinction between traditional BI and SSBI must be made. This will be done through a literature review.
- What are the different levels of self-service in BI?
    - There are different levels of self-service, it must be investigated which one are suitable in BI.
- What level of self-service is the most suitable for micro companies?
    - Because micro companies have specific characteristics it must be investigated which level of self-service is the most effective.
- What are the main success factors of SSBI?
    - It is crucial to understand the success factors, in order to guarantee a successful implementation in a company.
- What are the benefits of SSBI in a micro company?
    - We have to understand the benefits in terms of business and successful decision making for companies.
- What are the barriers of SSBI in micro companies?
    - For a critical consideration of SSBI, the barriers, especially in micro companies, need to be examined.
- What is the role of data in SSBI for the case?
    - Finding the right data for BI is one of the most challenging parts. The quality factors of the data need to be defined. Because every implementation is different, the specific role of data for the case study must be researched.

As a research methodology, scientific quantitative and qualitative methods will be used. The following chapter describes in detail how the research method is chosen for this master thesis.

In the first phase, there will be a quantitative document review of the relevant scientific literature. This method is used to cover the theoretical part of the thesis. This includes the theoretical parts about SSBI. To solve the problems confronted in this study, the TOE framework will be used (Tornatzky, Fleischer & Chakrabarti, 1990). Thus, the three elements of the framework, technological, organizational and the environmental context will be examined more closely regarding the implementation of SSBI in ME (Baker, 2012). In the technological component, the characteristics and usefulness of SSBI will be described. The organizational context contains the internal issues within the company such as management, employee, products, and services. Within the environmental context, all external factors that exist in the business field will be investigated.
The TOE framework is widely used in the adaption of new technologies. thus this will be

the main framework used in this study (Chiu, Chen & Chen, 2017). The technological context describes all the technologies that are relevant for the implementation of SSBI, this is both technologies that are already in use, as well as those that need to be acquired externally (Collins, Hage & Hull, 1988). The objective of this dimension is to identify the technological limits and to show how technology can enable the firm to evolve and adapt SSBIS. There are three types of innovations, those that create incremental, synthetic or discontinuous changes (Tushman & Nadler, 1986). To identify the component of this dimension, the theory of diffusion of innovations (Chiu, Chen & Chen, 2017) that refers to "Relative advantage", "Compatibility", "Complexity", "Trialability" and "Observability" as main technological factors for new innovations will also be addressed. The organizational context of the TOE framework refers to the characteristics and resources of the firm (Baker, 2012). A very important orgfetanizational factor for the adoption of new innovations is, for example, the support of high-level executives (Low, Chen & Wu, 2011). Other important factors are "Information Intensity" "Management Support", "Employees Knowledge", "Absorptive Capability", (Chiu, Chen & Chen, 2017). The third dimension of the TOE framework is the environmental context. It includes the structure of the industry, the presence and absence of technology service providers and government regulation. For example, a competitive environment stimulates the adoption of new technologies (J. Baker, 2012). Factors that determine this dimension can be "Competitive Pressure", "Business Partners","External Support" and "Governmental Support" (Chiu, Chen & Chen, 2017). In this context, the objective is to identify all relevant technology, organizational and environmental factors that may influence the adoption of SSBIS in micro companies.

In the second phase, a case study will be perform by the implementation of a SSBIS prototype in a micro company (ABC Travel & Consulting GmbH). The prototype used will be the SSBI solution Mircosoft Power BI. This will make it possible to gain an insight into how micro companies can profit from this type of software and the challenges they face. Following on from this qualitative interviews with open and closed questions will be conducted with relevant stakeholders, relevant decision makers like the CEO. The interviews will be held personal and will be recorded and transcribed in its entirety. The results from this phase will help the reader to understand the relevant benefits and barriers of SSBIS for micro companies, as well as other relevant factors. Furthermore, the implementation process of the prototype may allow the company to gain experience in the usage of an SSBIS, as well guide them to improve business performance and to give them a competitive advantage.

Finally, in the third phase, the objectives of the thesis will be to analyze the results of the previous phases to answer the research question. Thus, the results of the case study will be assessed according to the dimensions and factors of the TOE framework. Additionally, a SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis will be conducted to properly address the main features of SSBIS. The analysis will help to identify key issues which affect business development and entreprises growth (Pickton & Wright, 1998). The SWOT framework will be used to identify the strengths and weaknesses through an analysis

of the resources and capabilities, and will also identify the threats and opportunities for micro companies that arise as a result of the implementation of an SSBIS (Stacey, 2011).

# 1 THEORETICAL BACKGROUND ABOUT SSBI

## 1.1 Self-service technologies

In today's competitive environment, service marketers are constantly looking for new, innovative ways to meet customers wants and needs. At the same time companies are trying to reduce labor costs. A practice-proven solution that combines both objectives is the usage of self-service technologies (hereinafter: SSTs) (Lee & Allaway, 2002, p. 553).

The following chapter will introduce a definition of SSTs and will discuss various aspects of this technology. Furthermore, the different levels of self-service will be explained.

### 1.1.1 Definitions

In 1917 the term "self-service" was introduced to the business world. Back then the U.S Patent Office granted a patent for a "self-service store" (U.S. Patent No. 1242872A, 1917). Grocery stores, that licensed this business method, now allowed customers to collect items themselves and present them to a cashier. Before that clients needed to give a shopping list to a store clerk who then collected the items for them (Shaw, Curth & Alexander, 2004, p. 570). Therefore the term self-service is defined as "a system in which customers are not served by an employee, but collect goods or food themselves" (Cambridge University Press, 2018).

The use of the term "technology" has changed scientifically over the last few centuries. Before the 20th century it was mostly used to describe practical subjects such as manufacture and craftsmanship (Buchanan, 2018) or the term referred to technical education (Stratton & Mannix, 2005, pp. 190–192). The word's meaning changed in the early 20th century with the second industrial revolution (Schatzberg, 2006). So, American sociologist Read Bain wrote in 1937 that "technology includes all tools, machines, utensils, weapons, instruments, housing, clothing, communicating and transporting devices and the skills by which we produce and use them." (Bain, 1937, p. 860). This definition still remains in common usage today, even though scientist and engineers usually define technology as an applied science (MacKenzie & Wajcman, 1999, pp. 9–10). According to the English dictionary Merriam-Webster, the term can also be defined as "the practical application of knowledge especially in a particular area" (Merriam-Webster.com, 2018).

The term self-service technologies (SSTs) can be derived from the definitions of the terms self-service and technology. Thus, SSTs are "technological interfaces that enable customers to produce a service independent of direct service employee involvement." (Meuter, Ostrom,

Roundtree & Bitner, 2000, p. 50). This explanation implies that SSTs are characterized by two aspects. First, the service is enabled through technology and the customer interacts with a machine instead of a person during the service process (Cunningham, Young & Gerlach, 2008, p. 723). Second, the customer is a co-producer of the service (Vargo & Lusch, 2008, p. 2). Examples of SSTs include ATM's (automated teller machines), automated hotel check out, online transactions such as investment trading, fully automated phone systems and self-service business intelligence systems (Curran & Meuter, 2005, p. 103).

### 1.1.2 Self-service Technologies

The internet has changed the interactions between clients and service providers in many ways. It is playing an increasingly significant role in the way in which services are delivered to the customer (Bobbitt & Dabholkar, 2001, p. 424). Although the internet enables a lot of SSTs there are also other technologies that enable self-service (Meuter, Bitner, Ostrom & Brown, 2005).

Table 1 gives an overview of the SSTs that are available to customers today. It is not an exhaustive list but it gives an idea as to what is possible through the usage of self-service (Meuter, Ostrom, Roundtree & Bitner, 2000, p. 52).

*Table 1: Categories and examples of SSTs in use*

| Interface / Purpose | **Interactive Voice Response** | **Online/Internet** | **Interactive Kiosks** | **Video/CD** |
|---|---|---|---|---|
| **Customer service** | - Telephone banking<br>- Flight information<br>- Order status | - Package tracking<br>- Account Information | - ATMs<br>- Hotel checkout | |
| **Transactions** | - Telephone banking<br>- Prescription refills | - Retail purchasing<br>- Financial transactions | - Pay at the pump<br>- Hotel checkout<br>- Car rental | |
| **Self-help** | - Information telephone lines | - Internet information search<br>- Distance learning | - Blood pressure machines<br>- Tourist information | - Tax preparation software<br>- Television/CD based training |

*Source: Meuter, Ostrom, Roundtree & Bitner (2000).*

Examples of SSTs enabling customers to produce their own customized services abound. For example, Amazon.com revolutionized the image of retail shopping. The company allows

customers to buy almost every conceivable book online, just by typing in the related keyword. Customers use a virtual shopping cart and can easily browse, explore related titles, and purchase all the items at once. Based on clients past ordering history, they also receive customized advice in the form of personalized book recommendations (Linden, Smith & York, 2003, p. 76). Similarly, Wells Fargo Bank changed the service standards in the finance sector. The bank offers a wide variety of self-service. Through the online portal, customers can view their account information, pay bills, transfer money, apply for new account or invest in the stock market. In addition to this the bank also provides a 24-hour banking system offering more than 150 types of services and maintains a vast network of ATM's. They enable customers to access any combination of banking services, 24 hours a day, 365 days a year (Bitner, 2001, p. 377). A pioneer in a business-to-business context in providing self-service for their customers is FedEx. Through the usage of SSTs, the company gives access to package tracking, information storing, billing and provides access to the FedEx online portal. Customers receive service when they want it and are able to customize the service on their own (Bitner, Brown & Meuter, 2000, p. 144).

There are typically three goals that a business hopes to achieve with the adoption of self-service technologies. The first goal is to provide technology delivered customer service, with the intent to provide customer service without tying up the company's human resources. If the implementation is carried out correctly then the firm will also save financial resources. Some examples of this are: providing product information to customers, online troubleshooting systems, internet-based package tracking, and online/phone banking (Chang-tseh, 2005, p. 78). The second goal of SSTs is to engage customers in direct transactions with the company's products or services through the use of technology (Ostrom, Bitner & Meuter, 2002, p. 46). Examples for this sort of SSTs include: automated kiosks, online shopping, online trading and travel and ticket services. The third goal of the integration of SSTs is education, whereby the customers are able to educate and train themselves. Information homepages, training videos (via DVD or Internet) and phone-based information lines are some examples of related to the educational objectives of SSTs (Chang-tseh, 2005, p. 78).

### 1.1.3 Different levels of self-service

According to the Customer Maturity Matrix, there can be derived five different levels of self-service. The level of service maturity rank from one to five, with five being the most sophisticated. As the majority of SSTs are delivered through web technologies, a mature web and mobile self-service strategy is important to reach a high level of self-service. Self-service means that the customer can fulfill their needs without of any external help. Thus, to provide a satisfying self-service experience, companies need to reach a high level in all five competencies of the Customer Experience Maturity Framework (Astutesolutions.com, 2017). The five core competencies which determine the level of self-service are described below and the complete Customer Maturity Matrix with all the necessary competencies is displayed in table 2.

1. *Channel Choice*: to offer customers a satisfying service, the right channels need to be offered, if a client prefers one channel he should not be forced to use another channel (Schoenbachler & Gordon, 2002).
2. *Personalization*: the more personalized a service offer is, the higher is the response rate of the customer, therefore it is an important competency (Aguirre, Mahr, Grewal, de Ruyter & Wetzels, 2015).
3. *Self-service*: people want to use the full service offer without depending on employees and office hours (C. Meyer & Schwager, 2007).
4. *Escalation*: when a customer cannot find an answer on their own, they need to be forwarded to another department, therefore an efficient escalation strategy is needed (Smith, 2005).
5. *Voice of Customer (hereinafter: VOC)*, is the process of capturing customers' requirements. It produces a detailed set of customers' wants and needs which the company can use to provide a sophisticated customer experience (Gaskin, Griffin, Hauser, Katz & Klein, 2011, p. 6).

*Table 2: Astute Customer Experience Maturity Framework*

| Competency / Level | Channel Choice | Personalization | Self-service | Escalation | Voice of Customer |
|---|---|---|---|---|---|
| **One** | Customer service only through traditional channels. | No personalization. Customer receives standardized Responses. | Self-service is available only on the contact page of the website. | Customers have only the choice to call the service hotline. | Some data is being collected. Reporting capability is limited. |
| **Two** | Supporting text-based chat and social media for customer available. | Customer communication is personalized, use of some data. | Customer self-service is accessible across every page of the website. | Options beyond the service hotline, lack of Automation. | Some data is accessible and available. Insights are difficult. |

table continues

table continued

| Competency Level | Channel Choice | Personalization | Self-service | Escalation | Voice of Customer |
|---|---|---|---|---|---|
| **Three** | Optimized multi-channel customer support available, but lack of integration. | Reactive interaction with deeper level of personalization. | Multiple channels for self-service, but no integration between them. | Some level of automation. Only limited information is passed to agent. | Collecting at least 2 types of VOC data, but data is not consolidated. |
| **Four** | Customer experience is optimized but agent experience is limited and inefficient. | Proactive communications are now on same level as reactive interactions. | Integration between self-service channels. Unified strategy and experience across platforms. | Responding agent, receives full context of previous interactions. | Collecting all 3 forms of VOC data and able to consolidate to gain best insights. |
| **Five** | Support all channels customers want and have optimized agent experience. | Individualized communication, Cross-channel integration provides consistent personalization. | Consistent experience that is automated and device-optimized. Uses of artificial intelligence. | Best agents are paired to most valuable customers. Opti-channel approach. | Collecting and consolidating all VOC data and reporting includes real-time and actionable insights. |

*Source: Adopted from Astutesolutions.com (2017).*

## 1.2 SSBI foundations

According to the Business Application Research Centers, SSBI is a powerful trend that is gaining momentum in the delivery and use of BI software. Financial reasons and time considerations are the cause to let end users create their own reports and data analyzes, without applying for IT support (Bange, 2014)

The following chapter will describe the foundations, definitions and components of SSBI.

### 1.2.1 Definition

The term SSBI is composed of self-service and business intelligence. A definition of self-service was already given in chapter 1.1.1.

The Gartner Group Inc. is one of the leading companies in the field of BI and was one of the first firms to use the term "business intelligence" in the mid-1990s (Shariat & Hightower, 2007, p. 40). They referred in one of their reports to BI as "…making sound business decisions based on accurate and current information takes more than intuition. Data analysis, reporting, and query tools can help business users wade through a sea of data to synthesize valuable information from it – today these tools collectively fall into category called Business Intelligence" (Gartner Group, 1996). The meaning of the term developed to the following definition "Business intelligence" is an umbrella term that includes the applications, infrastructure and tools, and best practices that enable access to and analysis of information to improve and optimize decisions and performance" (Gartner Group, 2018). According to this definition, BI systems are tools which support decisions through the provision of actionable information at the right time, at the right location and in the right form. The goal of BIS is to facilitate managerial work and to improve the timeliness and quality of input in the decision process (Negash, 2004, p. 178).

Derived from the definitions of the terms "self-service", "self-service technologies" and "business intelligence" it can be said that through the usage of self-service business intelligence users shall become able to use BI solutions without explicit BI/IT knowledge. For an explanation of SSBI we refer to the following definition: "The facilities within the BI environment that enable BI users to become more self-reliant and less dependent on the IT organization. These facilities focus on four main objectives: easier access to source data for reporting and analysis, easier and improved support for data analysis features, faster deployment options such as appliances and cloud computing, and simpler, customizable, and collaborative end-user interfaces" (Imhoff & White, 2011, p. 5). The definition implies that SSBI tools should be intuitive and easy to use (Schlesinger & Rahman, 2016, p. 14). Furthermore, it should be metadata dictionary to allow the knowledge workers to understand the underlying data (Foshay, Mukherjee & Taylor, 2007).

### 1.2.2 Components of SSBI

SSBI systems consists of similar components as traditional BIS, there are three components that are the most common through the literature that characterize a SSBI system. These are logical Data Warehouse, data preparation tools, and an alternative OLAP tools (Olszak, Ziemba & Alex Koohang, 2006, p. 49).

#### *1.2.2.1 Logical data warehouse*

An important component of a SSBI system is a *logical data warehouse*. The basic idea of the data warehouse is simple: data from the operative systems are copied into a separate database. If necessary, the data will be prepared for carrying out corresponding queries and analyzes. A data warehouse is a tool for storing decision-relevant information. The goal is to improve the company-wide information supply. Every data warehouse is unique, thus it is a solution tailored for the specific needs of the company (Grothe & Gentsch, 2000, p. 52). The idea of a SSBI is that different departments of companies can dive into the data and run analytics without having to submit a formal request to IT. For example, the marketing department might analyze the performance of marketing campaigns based on data from the CRM while the sales team might use another tool to analyze the sales performance. There is also data, such as unstructured social media data that is not made for a traditional data warehouse. To solve the challenge of different data sources a SSBI should have a logical data warehouse (Shankar, 2017). A logical data warehouse does not contain any data, instead it contains the intelligence and the logic for accessing the various sources, including the necessary security credentials. The data sources may include structed, semi structured or unstructured databases, flat files, cloud-based storage repositories and also traditional physical data warehouses (Merv, 2011).

#### *1.2.2.2 Data preparation*

The second important component of a SSBI system is the *data preparation.* It is "the process of preparing and providing data for data discovery, data mining and advanced analytics" (BARC, 2017). In SSBI it is used to integrate the various data types into the SSBI system. In traditional BI, Extraction-Transformation-Loading (hereinafter: ETL) tools are used for the extraction of data from several sources, their cleansing, customization and insertion into a data warehouse (Theodoratos, 2002). A SSBI system does not necessary need a data warehouse, so ETL tools are only needed if the SSBIS integrates a data warehouse. "There is a big myth in self-service which is that you can just somehow open a big database and the users are going to go make sense out of it, typically, there has to be a lot of prep work to get something in place. It doesn't matter what kind of self-service it is. IT, data people, whoever -- technical people -- have to do a fair amount of prep work to get at it and make it available." said Philip Russom, TDWI's director of research for data management. There are a dozen data preparation tools available on the market. Some have rich scripting and data mining features, others provide automation and a modern user experience intended for nontechnical users. With data preparation, users are able to quickly and easily access, manipulate, enrich and combine disparate data from various sources and prepare it for analysis (Moreno, 2017).

#### *1.2.2.3 OLAP alternative*

Traditional BI systems rely on data from an integrated and consisted data warehouse which is constantly fed with operational data. According to the OLAP approach (online analytical processing), data is stored in multidimensional cubes, and with the help of OLAP techniques

like slice and dice, the cubes get consolidated. To change the structure of OLAP cubes, expert IT knowledge is necessary (Golfarelli, Rizzi & Pagliarani, 2009, p. 29). Thus, another important component is the usage of an *OLAP alternatives* (Abelló and other, 2013) suggests the usage of Fusion Cubes, which is different to traditional multidimensional cubes as it can be dynamically extended in its schema and its instances. Furthermore, each fragment of data and metadata is associated with a set of explanatory notes that describe its quality from different points of view, the source it was taken from, its validity and its reliability (Abelló and other, 2013, p. 69). Also the usage of data lakes has been suggested (Harris, 2017). It is a methodology based on low cost technologies that improves the capture, refinement, archival and exploration of raw enterprise data. A data lake contains unstructured or multi-structured raw data (Fang, 2015, p. 820). Another alternative is the usage of in-memory database management system (hereinafter: DBMS) (Harris, 2017). The memory of a computer offers higher access speeds than hard disk and the algorithms for access are simpler. Therefore, in-memory databases are much faster, and their access times are more predictable than those of disk-accessing DBMS. As in-memory databases store their data in volatile memory, which they lose in the event of system crashes, it is harder to meet the requirement of persistent storage after a successfully completed transactions (Vizard, 2012). It is also possible to implement hybrid in-memory databases, which are database systems that can store data in both the main memory and hard disks. That makes it possible to achieve the right balance of performance, cost, durability and form factor during operation (Cole, 2007). As small companies normally don't have very complex data structures, another alternative for the technologies mentioned before, is the direct data analysis with OLAP similar techniques provided by the SSBI tool itself. (Mihai, 2017). Self-service tools eliminate the technical knowledge requirements for business users and the need for IT assistance, because they are designed for analytics via a visual interface. Upfront data modeling is not necessary with the usage of SSBI tools and can be used with a lot of different kind of data sources. They offer the same kind of multi-dimensional interactions with data sets that originally required the use of OLAP cubes. Users can define and adjust their own drill paths based on their need, and data structures don't need to be structured into a data cube during data modeling (Harris, 2017).

### 1.2.3 Difference between traditional BI and SSBI

The components of a SSBI and a traditional BI system are different, as already described in chapter 1.2.2, but there are some additional characteristics that may differ between these two models as described in the following chapter.

#### *1.2.3.1 Architecture*

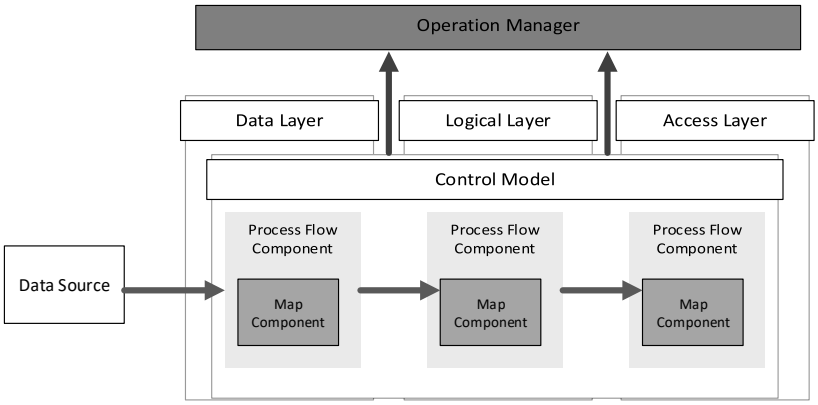
The traditional BI architecture is composed of three layers: data layer, information layer and access layer (Baars & Kemper, 2008, p. 137):

1. The data layer is responsible for storing various types of data. Usually structured data is kept in data repositories like data warehouses or data martes whereas unstructured content is handled by content and document management systems. The data is extracted from source data and before the data can be analyzed in a valid way it has to be transformed in several steps (Kemper, 2000).
2. The logical layer provides the functionality to analyze the various data types and supports the distribution of relevant knowledge. The analytical functionality includes OLAP and data mining but also the functionality to generate business reports, ad hoc analysis and to implement concepts like the balanced scorecard or value driver trees (Cheng & Cheng, 2011).
3. The access layer allows the user to use all the relevant functions of the logic layer in an integrated fashion. It is usually realized with some sort of software that provides a convenient graphical user interface (Priebe, Pernul & Krause, 2003).

Zaghloul and collaborators (2013) suggest a new SSBI business analysis framework with the same layers as the traditional BI architecture but using a process centric approach with different components for each layer. There are four main components which will play the main role of connecting this layer: map component, process flow component, control model and the operation manager, as depicted in Figure 1 (Zaghloul, Ali-Eldin & Salem, 2013).

1. The map component takes over the function of the ETL. It starts from the data layer and continues until the business Layer. The idea is that with the usage of a map component it is not necessary to use a third-party tool for the ETL process.
2. The process flow component is responsible for allowing the other components to function. It allows the next function in the flow to start automatically once the previous function is done. This component is the backbone of the suggested SSBI structure including all the business rules required to move from one function to the next.
3. The control model is responsible for managing and monitoring all the activities of the map component and any other component that might be integrated within the framework in the future to execute any other functions. When integrating external components into the framework, a metadata file needs to be integrated so that the control component is able to execute and manage the activities of all process flows and map components.
4. The operation manager is made up of two user interfaces, one for the business users and another for the technical users responsible for managing the process flow operations It is a single point of access that allows users to monitor, control and configure most of the framework functions.

*Figure 1: SSBI framework*




*Source: Zaghloul, Ali-Eldin & Salem (2013).*

#### *1.2.3.2 Reporting*

SSBI tools provide easy operation of the reporting system in the preparation of ad hoc reports or analyzes. It also allows cooperation between users (collaboration). Further to this, it is also possible to integrate its own, often Excel-based evaluations as well as other sources in an existing dashboard. Users don't need specific IT knowledge. In comparison to this, with traditional BI tools users can only access predefined reports which were previously created by the IT team (Rohrmoser, 2013). SSBI tools are typically intuitive and interactive and let users explore data beyond what the IT department has curated. Furthermore, they also allow the user to create reports for mobile phones and to publish them on the web (Blitz, 2017).

#### *1.2.3.3 Costs*

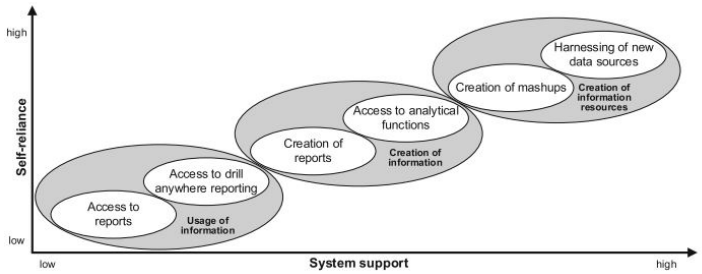
The costs of implementing SSBI can be considered qualitatively and quantitatively. Quantitative analysis varies from company to company, from organizational form to organizational form and from case to case. The qualitative costs analysis can be generalized in most cases. The difference with the implementation of traditional BIS is that the costs for the IT will drop and the expenses department will rise. There is a cost shifting through SSBI from IT to the individual department. However, with an SSBI there are overall less or maximum equal cost. Furthermore the implementation leads to higher satisfaction in both areas (Spieß, 2012). SSBI have comparatively low entry costs that allow micro-enterprises to exploit their data in a way that was once only possible for much larger companies (Humphries, 2017).

### 1.2.4 Different levels of SSBI

There can be distinguished three different levels of self-service in BI. To each of these levels there can be assigned different tasks. An equivalent classification is shown in Figure 2. The system support necessary varies with these tasks and different BI applications exist for each of the levels. Some only extend traditional BIS, while other are stand-alone SSBIS. Some of

the features already exist in traditional BI but the implementation for a large group of user, the user friendliness, and the power exceed the possibilities of traditional BIS (Alpar & Schulz, 2016, p. 154).

*Figure 2: Levels of SSBIis*




*Source: Alpar & Schulz (2016).*

### *1.2.4.1 Usage of Information*

This is the lowest possible level of self-service. Users can only access already created reports or can set few parameters before processing them. The difference to traditional BI reports are that user have access to all reports that are potential relevant. This is approach is especially well-suited for business users without special analytical or tool skillsets. With this approach it is difficult to gain deep insights into the data. Only basic insights can be obtained. This level can be improved with the implementation of a "drill anywhere" possibility for reports and dashboards (Eckerson, 2009). Users start their analysis usually on a highly aggregated level, but they can drill down predefined paths to answer more specific questions, step by step until they acquire the information they need. For analyzing data that is not include in the data warehouse, these don't need to be imported into the system. A switch to these sources is very intuitive or the users do not notice it at all. This guidance simplifies the analysis for the user but it remains restricted to what has been prepared by an IT specialist before (Bessa, Branco, Costa, Gonçalves & Moreira, 2018).

### *1.2.4.2 Creation of information*

On the second self-service level, to create new information, users can get access to data on the lowest particular level in the system. It can not be foreseen which needs consumer have, thus it is favorable to give them the capability to create new information. In traditional BI this is possible though the usage of SQL (Structured Query Language), but this query language is difficult to use for business users and thus do not meet the requirements of self-service. With the usage of new self-service tools, virtual views can be created almost on the fly, even from big data files if necessary. Casual users can choose whether they want to analyze existing data as flat, relational or multidimensional files (Hänel & Schulz, 2014). Thus, BI specialists are no longer needed to select the necessary data. This however, carries

the risk of incorrect data. On the downside, casual users normally have less understanding for complex data relationships. Hence, it also carries the risk that incorrect data excerpts or aggregates are selected. In addition to the preparation of charts and reports, users can also give the chance to autonomously perform advanced analytics, like text mining or predictive analytics, that go beyond the analyses of historical data. Because these functions are highly complex, casual users are often not able to correctly formulate their analysis requirement. Thus, it is necessary to provide the analytical functions, without the need to master a statistical package. Especially when mathematically and statistically inexperienced users perform these tasks, the risk of a faulty analysis is given, because they have little chances to assess the correctness of their calculations (Meyers, 2016).

#### *1.2.4.3 Creation of information resources*

The creation of information resources is the highest level of self-service, functions at this level go beyond traditional BI systems. In traditional BIS, the data from various sources are combined and offered to the user as a unified source. Because there is a huge variety of data sources and varying user requirements, data preparation is becoming more and more challenging (Chen, Chiang & Storey, 2012). Thus, with SSBIS, business users can be given the opportunity to exploit new data sources for analysis that are not preprocessed by IT. New information resources get created due the combination of these data with corporate data. After a simple implementation into the system, they have the opportunity to load the data into their personal workspace. Complex systems enable autonomous integration of various sources with corporate data. This creates new sources of errors. Existing access rights must be respected if the data is shared with others, the usage of poor quality data shall be avoided and relationships need to be identified (Stodder, 2012). Another possibility on this level is to offer casual users different functionalities using reusable components that have been prepared by IT professionals. Because these elements have been already preprocessed they can be joined through simple drag-and-drop to form a so called mashup, e.g., in the appearance of a dashboard (Kobielus, 2009). This approach is more complex and involves IT-professionals, but it stays hidden to the business user.

#### *1.2.4.4 User roles*

The required BI skills depend on the flexibility that is offered to the user (Spahn, Kleb, Grimm & Scheidl, 2008). Thus, the idea of SSBI does not mean the same for everybody. To provide the right BI tools to the users, the needs need to be determined based on their specific tasks, their informational demands, their IT skills, and their analytic skills (Eckerson, 2008). Thus, the self-service concept can be adapted to the needs of any business user giving them enough flexibility without overstraining them with functionalities. A strict classification in different user groups according to their business function is not needed, because they have alternating needs and different skills independently on their function, it is sufficient to control the individual access rights to data. It makes sense to make a rough division of two user

types into casual and power user based on their analytical and tool skills. Power user produce information, either for themselves or for others and casual users consume information most of the time.

### 1.2.5 Data quality for SSBI

Business users can import all kinds of data into a SSBI, and because the IT department is often not included in the decision, and casual users lack technical understanding, there is a pitfall of including bad quality data. Decisions based on this kind of data have a high probability of leading to bad decisions that affect the business. Thus, it is very important to ensure a high quality for the data used in SSBI. The data only has value when it supports the decision-making process (Yeoh & Koronios, 2010). The quality rules should consider the value that data can provide to the company. There are six dimensions that need to be considered when determining the quality of data: completeness, uniqueness, timeliness, validity, accuracy and consistency. They will be explained in the following chapter (Askham and other, 2013).

#### *1.2.5.1 Completeness*

Completeness describes to which extend data is not missing and is of sufficient breadth and depth for the desired analysis (Daniel, Casati, Palpanas & Chayka, 2008). When defining the completeness, it must be distinguished whether zero values are allowed in the data model or not (Scannapieco, Missier & Batini, 2005). There are five different types of completeness, which are shown in Table 3. Table 4 shows an example of data set and functions to symbolize the various types of completeness.

*Table 3: The different types of completeness*

| Type | Definition |
|---|---|
| Value completeness | All attribute values defined as relevant of a tuple are present. |
| Tuple completeness | All attribute values of a tuple are present. |
| Attribute completeness | All values of an attribute (a column) are present. |
| Relation completeness | All values in the whole relation are present. |
| Tuple relation completeness | All tuples are present in the relation. |

*Source: Scannapieco, Missier & Batini (2005).*

The *tuple completeness* is satisfied if all attribute values of a tuple are present. In Table 4 the tuples with the Student-ID 129234, 239023 and 129329 fulfill the tuple completeness. The tuples with the Student-ID 328928 and 139203 are not complete because one or two values

are missing. The *value-completeness* is a weakened form of tuple-completeness. Here, a distinction is made between relevant and non-relevant attribute values. The value-completeness is fulfilled if the previously defined attribute values of a tuple are present. If the Exam date is defined as not relevant in Table 4, the tuple with the student number 328928 would fulfill the value-completeness. If all the values of an attribute (a column) exist in the entire table, the *attribute completeness* is satisfied. In Table 4 the attributes Student-ID, first name and last name fulfill this criterion. In contrast to this, one or two values are missing for the attributes Grade and exam day, so that the attribute completeness is not fulfilled (Panse & Ritter, 2009). The *relation-completeness* examines missing values in the whole relation. It does not matter which tuple or attribute lacks the value. Accordingly, in Table 4, there are a total of three zero values, and therefore the relation-completeness is not satisfied. In *tuple relation completeness* it is required that all tuples are present in the relation. So, if a whole tuple is missing, the tuple relation-completeness is not fulfilled (Scannapieco & Batini, 2004).

*Table 4: Example data for completeness*

| **Student-ID** | **First name** | **Last Name** | **Grade** | **Exam day** |
|---|---|---|---|---|
| 129234 | Peter | Maier | 9 | 22.05.2018 |
| 328928 | Hans | Ulrich | 8 | |
| 139203 | Andreas | Schneider | | |
| 239023 | Thomas | Torres | 7 | 01.06.2018 |
| 129329 | Lukas | Mueller | 5 | 21.05.2018 |

*Source: Own work.*

#### *1.2.5.2 Uniqueness*

A record must be uniquely interpretable, that is, the existing metadata must commit the semantics of the record. That means that there should not be data duplicates. To reduce the risk of accessing outdated information, each data record should be unique. For example, we may have in our database two clients that were registered as Tom Mueller and Thomas Mueller, which in fact are the same person, but the latter has the latest details. This data brings the risk that the Customer Service department may access outdated information under Tom Mueller and will not be able to contact the client. The quality dimensions are not always 100% met, meaning that data can be accurate but incomplete. Decision makers have to make conclusions based on data, thus it is important to perform a short audit of data before compiling KPI results in a performance report, based on the quality dimensions presented here. Thus, if there is a uniqueness issue or data is not complete, data users must be informed in order to avoid biased decisions (Fürber & Hepp, 2011).

#### *1.2.5.3 Timeliness*

All datasets correspond to the current state of the modeled world and are therefore not alienated. The data reflects the actual properties of the object in a timely manner. Lack of up-to-dateness can result on the one hand from the frequency of the charging cycles (e.g. weekly instead of daily) or on the other hand from the delayed maintenance of the data in the already operational system (e.g. no regular reassessment of collateral) (Apel, Behme, Eberlein & Merighi, 2015). According to Gamble and Goble (2011) timeliness is defined as "a comparison of the date the annotation was updated with the consumer's requirement" (Gamble & Goble, 2011). This quality dimension is important because it is possible to have current data but that is actually not suitable because it reflects a state of the current world that is too old for the specific use case. To guarantee that data will never become outdated, it should be ideally reported and recorded on a constant base as the source data values change over time (Rula, Palmonari, Harth, Stadtmüller & Maurino, 2012).

#### *1.2.5.4 Validity*

The term validity refers to the validity of the data collection. A data collection is valid if it measures what you wanted to measure. Thus, if it conforms to the syntax (format, type, range) of its definition. To ensure a fully functional SSBI, initial and ongoing data validation is important. A lack of data validation is a common error source and can even occur when an experienced team developed the BI model. A data model that is maintained on a continuous basis, reduces the likelihood of errors or inconsistent results. Thus, the continuous data validation leads to improved decision-making for the organization. However, a lack of data validation will lead to mistakes in the decision-making process, based on inaccuracies with the potential to impact the business, reputation and safety of the company (Burke, Simpson & Staples, 2016, p. 36).

#### *1.2.5.5 Accuracy*

Accuracy is also considered a very important criterion for data quality. This is about how exactly the data reflects the facts (Beutler, 2005). It means whether the values stored for an object have the correct values. To be accurate, a data value must be the correct value and must be represented in an unambiguous and consistent form. For example, the birthdate of a client is saved as 12. May 1974 and the personal data-base has the element DATE_BIRTH that expect dates in US format, so the date 05/12/1974 would be correct. A date 05/11/1974 would be inaccurate because it has the wrong value. A date of 12/05/1974 would be also incorrect because it is a European representation instead of a US format (Helfert, 2000, p. 64). Thus, accuracy is measured by how the values conform with an identified reference source of information that is free of error, such as comparing values against a database of record or with a set of data values from another table, checking against computed values or

it is also possible to apply a manual process to check value accuracy (Loshin, 2012, pp. 173–174).

#### *1.2.5.6 Consistency*

The attribute values of a dataset have no logical contradictions among themselves or to other datasets. Inconsistent data within the operational systems lead to massive credibility problems in the analytical systems (Apel, Behme, Eberlein & Merighi, 2015). This quality dimension applies whenever a dataset is kept in more than one place. It is about ensuring that data values in one data set are consistent with the values in another data set (Loshin, 2012). For example, if there is an employee repository as the system of record for employee data and another system (like a monitoring stream) as a downstream replica, a periodic consistency check should be executed. Data can be evaluated for consistency in view of its relation to other systems data, or even within the same system. For instance, a high-performance system that caches regular accessed data also runs the risk of potential issues in terms of consistency. All such controversies should be flagged through exception reporting and investigated, whether between or within systems. The process errors that caused the consistency issues to occur must also be investigated and fixed. Finding and fixing such problems may require a few rounds of experimentation, but these are baseline requirements for an unbiased SSBI system (Cong, Fan, Geerts, Jia & Ma, 2007).

### 1.2.6 Challenges of SSBI

With the introduction of a SSBI in a company, several challenges may occur. The following chapter better describes these aspects.

Due to the relocation of tasks from the IT-department to the specialist departments, the usability of the SSBI tools is an important basis for the acceptance of SSBI as a complete package (Jooste, Biljon, Mentz & Jooste, 2014). It is an important challenge to ensure that a SSBI environment allows users to work efficiently with the tools. This means, a SSBIS needs to allow easy modeling, make access to data sources as easy as possible, ensure high performance and scalability for the delivery and use of user applications, as well as easy management and offer easy access to the finished applications. Moreover a possibility for user modification of applications and reports should be provided (Imhoff & White, 2011, pp. 5–8). A prerequisite is the creation and provision of an adequate infrastructure and the necessary development environments (SSBI environment). This includes the availability of sufficient resources (including support staff) that should be easily expandable as their usage increases. Since different responsibilities for IT tasks are often defined within a company, the close cooperation and coordination of the IT departments responsible is extremely important. Monitoring, care and maintenance of the SSBI environment are tasks that should be fully accounted for and not casually understood (Lönnqvist & Pirttimäki, 2006).

Data provisioning and data governance are also fundamental requirements for enabling and promoting the use of self-service BI (Imhoff & White, 2011). In particular, data from transactional and operative systems is meant here. A business user who does not have access to the data needed, cannot use SSBI. Business users can benefit from easy access to data in this regard, i.e. the data should be easy to find and reach. User-friendly tools with access to various data sources, are supportive. Usability is the foundation for the acceptance of a self-service tool in a company. Thus, it is a challenge to provide an understandable system for non-technical users as well as to provide easy access to the right data (Richardson, Schlegel, Sallam & Hostmann, 2009).

Previous experiences show that it is important to specify which kind of data can be made available to users. The data does not necessarily have to be in a so-called snowflake or star schema (Minelli, Chambers & Dhiraj, 2013). Even a freely accessible database (relational) has proven to be an adequate data access level. It can be problematic to just adopt, technical terms from an ERP, because casual users might not understand them. In this regard with the implementation of data governance, it can be ensured that the data is sufficiently enriched so when using the data, business users can be sure that they are also working with the data they need and want (Khatri & Brown, 2010). A first step may be the conversion of the technical designations into defined "friendly names". When using data from other sources (Internet, etc.), in the context of data governance, it is necessary to create policies that define standards, such as typical names for data (Vercellis, 2009).

For access to the data, a security concept has to be developed which defines which departments and users have access to which data. Often, a company has a lot of employees and not all of them have the same access rights. Thus, it is a challenge to implement the security concept into the SSBIS and guarantee all users the access they need.

Since companies are divided into several business areas, it must be discussed whether data can be accessed across different business units. This aspect potentially requires a differentiated consultation and coordination within the company (Horvath, 2001). In addition, training the specialist users and departments in how to use the application of the SSBI is essential (Gamble & Goble, 2011).

### 1.2.7 Success factors of SSBI

From the challenges several success factors for the successful implementation of a SSBIS can be derived. Usability is a principal factor for the acceptance of a self-service tool in a company's business intelligence processes. In addition to the usability, an adequate data management architecture and data governance are other success factors.

The use of self-service functions does not necessarily require the purchase of a special BI tool as a stand-alone solution. Often, the existing BI platforms in companies already offer

self-service functions. End-user-friendliness is a top priority for platform-based self-service functions (Imhoff & White, 2011).

#### *1.2.7.1 Ease of use*

As previously mentioned, the usability is one of the main success factors when it comes to the implementation of a SSBI. If the SSBI tool does not appeal to the business users, they will simply not use it. Whether a tool or system is user-friendly, can be determined by the following aspects:

- Equipment with role-specific functionalities (sales, marketing, finances etc.)
- Simplicity in use
- The degree of flexibility and agility in generating reports on an ad-hoc and analytical basis
- User Interface / Surface Design (based on the familiar designs from known tools like Microsoft Office or apps)
- Individual search functions
- IT-independent access to various data
- Types of data visualization (graphics, corporate designs, etc.)
- Collaboration features
- Availability of additional data (e.g. metadata)

The most important criteria for using a self-service tool is the provision of role-specific functionality. The key here is to address two groups in the company: on the one hand, the power users with their special know-how for analysis and reporting. On the other hand, the end users who use BI tools only to display reports and dashboards and, if necessary, conduct simple modifications (Kobielus, 2009). If the mentioned criteria for the users are fulfilled in a satisfactory manner, a high degree of user-friendliness of the SSBI system can be expected. If the ease of use factor is met, it is important to address topics such as data management and data governance. It is important for companies to define which data treatment, control and stability policies and procedures are defined in order to ensure the best possible provision of information and to ensure the best possible use for business processes (Isik, Jones & Sidorova, 2011).

#### *1.2.7.2 User requirements*

Regardless of the solution approach - either using existing tools or implementing special self-service tools - users' requirements can in practice be divided into different categories: modifying reports and dashboards, creating ad hoc reports and dashboards, integrating private, local data and modifying data models. A SSBI solution must meet these user requirements to be successful, thus they are an important success factor. The various aspects of the user requirements will be described below. Data governance is of great importance in all

cases because it represents the elementary basis for an adequate self-service strategy with regard to the control and monitoring of processes. It can allow the user to act as a data steward, i.e. data manager, within the framework of given requirements and standard (Azvine, Cui, Nauck & Majeed, 2006).

#### *1.2.7.3 Modifying reports and dashboards*

The use of self-service tools supports users in the individual modification of reports and dashboards. Power users can filter according to their own key figures and structures and generate simple reports. With the preparation of analyses for a specific purpose, the users can operate independently and from these gain unique insights into the business processes. Furthermore, report customization can be easily carried out by calculation and creation of new figures, graphics and views. Consequently, self-service functions give users a higher degree of flexibility during report generation (Demirkan & Delen, 2013).

##### *1.2.7.3.1 Creating ad hoc reports and dashboards*

The creation of reports and dashboards is no longer the sole task of the IT department. With intuitive tools and predefined reports and dashboard objects, power users can now create ad-hoc reports and dashboards to support end users. The extension of ad hoc functionalities by analytical functions, contributes to the user-friendliness of a solution. The advantage of this is that, for example, dashboards can be mapped according to the exact ideas of the user. A central, semantic layer is technically fundamental for the entire reporting process. This serves to encapsulate the complexity of technical data modeling for a business user and translate it into an understandable form. The number of connected data sources is not visible and is only presented to the end user as a kind of library with available data objects. This enables a much easier access to the many different data sources in a company (Berthold and other, 2010).

##### *1.2.7.3.2 Integrating private, local data*

Another success factor in the user requirements is the integration of independent private, local data. These are, for example, taken from Excel documents, TXT or CSV files or can come from externally provided data sources. There are three different ways of integrating this data. Firstly, data can be entered directly or together with other data into a data warehouse or other centralized and shared data stores. Data federation technologies can also enable an architecture in which data remains in its original data sources (e.g. ERP systems) and does not have to be transferred to other data stores (e.g. data warehouse). The second way is to implement metadata of private, local data into one or more semantic layers. In the BI environment, the user has access to data that is centrally provided as well as to local data for their reports and analyses. Finally, local data can also be integrated directly into reports by linking the report data with local data via keys (Minelli, Chambers & Dhiraj, 2013).

In general, self-service functions offer business users a fast and self-service option for integrating data into their reports. The self-service tools work in such a way that, for example, Excel files can be inserted into the user interface by dragging and dropping, whereby the system automatically recognizes their structure in the background. As well as this local, private data can be combined with data warehouse data (Abelló and others, 2013).

#### *1.2.7.3.3 Modifying data models*

For power users, self-service also means the possibility of independently modifying or generating data models. The user acts as a "data modeler" and can adapt the data view according to their own ideas. This enables the user to simulate scenarios, e.g. to map forecasts for future business processes or to compile statistics on business figures. Technically, data modeling can be performed in a metadata layer, in a database or in so-called "sandboxes" (this corresponds to a controlled database/business intelligence environment). However, this depends on the strategy and the implemented software solution of a company (Demirkan & Delen, 2013).

#### *1.2.7.3.4 Data steward*

Monitoring and improving data quality is a task for business users who use self-service tools. This integrates business into the data governance process. The task in the administration of the data consists of checking the Validity of data, data entry and adaptation. In addition, data from the user, the validity of which they are responsible for, can be modified directly and they can create validity rules. For successful administration of the data set, the close cooperation between IT and users is fundamental (Jaklič, Popovič & Coelho, 2009).

#### *1.2.7.3.5 Data management architecture*

To ensure that the SSBI implementation is successful, an adequate data management is important. Thus, it should be ensured that the entered data meets the quality criteria which are described in chapter 1.2.5. To ensure a sophisticated data management architecture, a multidimensional data model should be implemented. In the case of SSBI systems, queries and analyses are carried out almost always over more than two dimensions. Hence the description of multidimensionality. An exemplary question for such analyses would be: what turnover was generated with product 1 (1st dimension) in the Eastern region (2nd dimension) in 2005 (3rd dimension). The three dimensions of product, region and time are queried (Jetter, 2004). Multidimensional data spaces are characterized by several aspects. Above all facts, dimensions and hierarchization play a role. Facts or measures are usually figures such as sales revenues, quantities or costs that are at the center of the data analysis. They are inside

the data cube. These are usually key business figures that have the task of depicting interrelationships in a condensed, quantitative form. These can be base values (atomic values) or derived numbers (calculated values) (Leser, 2007).

The dimensional model delivers a simplified structure that business users can understand without any expert knowledge and that works seamlessly with the SSBI tools. It consists of an attribute change management. Furthermore, it provides an excellent query performance because of several factors:

- Fewer table joins because decodes and hierarchical structures are collapsed into a simple flat dimension table;
- Simple table joins because an efficient single column surrogate key always joins facts and dimensions;
- Database engine optimizations that recognize dimensional structures;
- Where possible, pre-calculation of metrics or attributes during the ETL process rather than at query time.

(Lorenzi, 2013)

#### *1.2.7.4 Data governance*

Wherever self-service BI applications have been in use for some time, users have often developed their own rules for the preparation, checking and aggregation of internally and externally related data. In the best case, they have saved the rules locally and apply them consistently - but often newly generated rules are used again and again. The lack of systematics often leads to inconsistent results in data analysis and thus to incorrect decisions. In cooperation with the business users, the IT department should therefore review the existing knowledge about the applied rules and decide which rules can be transferred to improve centrally controlled data governance and data quality (Weber, 2013).

Companies that implement SSBI, need to establish policies for data governance that define the data available for access and how it can be accessed. Furthermore, the desired quality criterions for the analysis need to be defined (Seiner, 2012). If decision-making and data use are carried out without explicit policies for data governance, user set up their own rules, which may lead to problems with the use of right data and access rights (Stodder, 2014). Hence, without a precise data governance structure, it can lead to wrong data analysis. Data management and governance must be clarified differently. Data management includes policies, procedures, practices and tools that are used to improve the usage of available data. Data governance is the enforcement of data management (Meyers, 2016). The aim is to achieve one vision of truth when using SSBI, and if users have access to all the data and interpret it differently, they may use different approaches that produce different results. Policies for data management and data governance avoid these problems (Lennerhol, Laere & Söderström, 2018).

Data governance is a fundamental aspect for adequate self-service use in the company. As an overarching concept, it provides a framework for monitoring the management and modification of data. The architectural goal of data governance is to combine the flexibility and independence for business users in the sense of the self-service functions presented with a data architecture that also guarantees the provision of central, quality-assured data. Thus, data governance ensures flexibility and independence for the users and at the same time provide the company with widely uniform and quality-assured data and others, 2017).

### 1.2.8 SSBI Tools

In this chapter we provide an overview of the most popular SSBI tools regarding their main benefits and downsides. Table 5 shows a summary of the characteristics of Domo, Microsoft Power BI, Qilk Sense, QuickSight, and Tableau (Baker, 2018d).

*Table 5: Overview of the most popular SSBI tools*

| **BI Tool** | **Special features** | **Benefits** | **Downsides** |
|---|---|---|---|
| Domo | Support of many data sources and diagram types | Integrated social media function | Relatively difficult to learn |
| Microsoft Power BI | Suitable for companies working with Windows, Office or Azure | Particularly cost-effective | Fewer analysis functions and chart options than the competition |
| Qlik Sense | High interactivity of data analysis possible | Visualizations individually adaptable | More intensive training necessary |
| QuickSight | Many data sources can be integrated, good data preparation | Simple analysis and visualization functions | Some visualization functions are missing |
| Tableau | Particularly powerful visual display | Very user-friendly overall | Quite expensive |

*Source: Baker (2018d).*

**Domo**: this tool provides a large number of connectors and has great sharing capabilities, furthermore it provides unlimited data storage. On the downside, it has clunky user interface and esoteric commands. Thus, it has a long learning curve, especially for new analysts. Domo is not for newcomers in business intelligence, but it can be a great option for companies that already have experienced BI staff (Baker, 2018a).

**Microsoft Power BI:** this is a very powerful tool with many data source connectors and is very easy to use. It provides superb data visualization capabilities. The negatives points are

that it divides data preparation tools between desktop and web versions, and the refresh cycle is only daily in the free version. On the other hand, Microsoft Power BI has sophisticated data visualization features, intuitive design and integrates excellently with the rest of the Microsoft Office suite (Baker, 2018b).

**Qlik Sense**: this tool provides custom access roles, has a solid collection of public data online and provides individual visualizations based on user roles. However, this tool is relatively hard to learn and has a complex cost structure (Rist, 2016).

**QuickSight**: in Amazon Quick sight many data sources can be integrated, and it provides a wide range of data preparation possibilities. On the one hand it provides simple visualization and analysis options, thus casual users can learn it quickly, but on the other hand through the simplification, some visualization functions are missing (Jones, 2016).

**Tableau**: this tool provides a large collection of data connectors and visualization options. Moreover, the processing engine of Tableau is very powerful. Another advantage is the large community of users. Moreover, it is not very complicated to use, meaning a significant training phase for successful deployments is not necessary. But on the downside, the tool is quite expensive (Baker, 2018c).

# 2 THEORETICAL BACKGROUND OF MICRO-ENTERPRISES

## 2.1 Definitions

In scientific issues, but also in economic policy discussions, the distinction of small and medium-sized enterprises SME to large companies is not always made clear. This makes it difficult to compare statistical evaluations and increases the risk that wrong conclusions are drawn about the overall economic importance of SMEs.

The Institute for Middle Class Research, Bonn defines companies with up to nine employees and less than a 1 million euros annual turnover as small companies and companies with ten to 499 employees and an annual turnover between 1 million euros and 50 million euros as medium-sized companies. The entirety of SMEs are made up of all companies with up to 499 employees or an annual turnover of less than 50 million euros (IfM Bonn, 2016).

Compared to the definition of the Institute for Middle Class Research, Bonn, the definition of SME in this thesis is based on that of the European Commission that consider two quantitative criteria of employment and turnover (EU, 2003).

In order to make a distinction between SME and large companies, the EU Commission recommends that qualitative aspects such as ownership and decision-making be taken into account in addition to purely quantitative characteristics. In the context of the discussion

among medium-sized businesses, the term "family business" is often encountered alongside the term "small and medium-sized enterprises". In contrast to the definition of SME, the definition of family businesses is based exclusively on qualitative aspects, i.e. there are no size limits. The Institute for Small Business Research, Bonn classifies all companies as family businesses in which a maximum of two natural persons or their relatives hold at least 50% of the shares of the company and where the management is in their hands. The intersection between family businesses and SME is big (EU, 2003).

## 2.2 Categorization of SME

According to the EU Recommendation 2003/61, SME are defined as those with no more than 249 employees and an annual turnover of no more than €50 million or a balance sheet total of no more than €43 million (EU, 2003). The categorization is illustrated in Table 6. These thresholds apply to individual enterprises. For a company that is part of a larger group, the number of employees and the turnover or balance sheet total of the group must be taken into account, depending on the amount of the investment.

In addition to the size of the company, the group of SMEs also differs in terms of industry, products and services that they offer in different markets (Rößl, 2005, p. 1). In the European Union, economic activities are classified according to the NACE code (Nomenclature générale des Activités économiques dans les Communautés Européennes). All enterprises (including agriculture, private and public budgets) are divided into 99 main groups by economic sector (Mugler, 2008, p. 28). Due to the heterogeneity within SMEs, a uniform picture cannot be assumed (Hauser, 2006, p. 17). For example, a small service company differs considerably in terms of management, organization and structure from an industrially oriented supplier to the automotive industry.

*Table 6: Categorization of SME*

| **Company category** | **Number of employees** | | **Turnover €/year** | | **Balance sheet total €/year** |
|---|---|---|---|---|---|
| micro | up to 9 | | up to 2 Million € | | up to 2 Million € |
| small | up to 49 | **and** | up to 10 Million € | **or** | up to 10 Million € |
| medium | up to 249 | | up to 50 Million € | | up to 43 Million € |

*Source: EU (2018).*

## 2.3 Characteristics of micro-enterprises

In addition to the quantitative demarcation criteria and the breakdown by economic sector, ME have specific organizational, management and resource characteristics. ME have the same characteristics as SME and often just differ in the number of employees, the turnover or the balance sheet total.

The literature contains corresponding catalogues of characteristics which serve to distinguish ME from larger companies. Characteristics catalogues are used to identify common characteristics of ME. These characteristics catalogues differ in scope and length. An ideal-typical catalogue of characteristics, which is representative of all companies, does not exist. According to Mugler there are the following characteristics on the demarcation of ME (Mugler, 2008, p. 28).

- The company is shaped by the personality of the entrepreneur, who is the manager and often also the owner.
- The entrepreneur has a network of personal contacts to customers, suppliers and other important contacts for the company.
- The company provides services according to the individual wishes of its customers.
- Contacts between management and employees are close and informal.
- The organization is not very formalized.
- The company can react quickly to environmental changes.
- The company is not operated by a larger company.
- The company has only a small market share

According to Mugler (2008), it is the exception rather than the rule that all these characteristics apply to one ME. What is particularly striking about this catalogue is that many characteristics refer to the personality of the entrepreneur. The impact of these personality traits on companies is discussed below. The transition from ME to SME and even larger enterprises can be smooth. In practice there are often companies with more than nine employees that have the same characteristics as ME, but also large companies with more than 249 can have the same characteristics. However, there also SME that have the same organization structure as big companies. It is rare that a micro enterprise can have the same structure due to the limited financial and personal resources (Mugler, 2008, p. 28).

#### *2.3.1.1 Leadership-specific characteristics*

ME are usually managed by the company owner (Pfohl, 2006, p. 18). The combination of owner and manager in one person means that for the company it is much more influenced by the personality of the entrepreneur than, for example, a large company that is managed by an executive board. This also means that an ME's existence depends on the abilities of

the entrepreneur and that business crises can only be overcome with the entrepreneur's insight (Bussiek, 1996, p. 41). The mostly technical oriented training of company managers leads to the conclusion that ME often lack management skills. As a result, many ME are not strategically oriented. ME tend to react rather than act, and improvisation and intuition predominate in decisions (Pfohl, 2006, p. 18). Such an approach cannot be rejected per se, because the success of ME acting in this way proves them right. Nevertheless, a structured entrepreneurial approach is of high importance for the success of ME (Wegmann, 2013, p. 185).

As a management style dominates in owner- or family-run ME a patriarchal style of leadership can often be found (Pfohl, 2006, p. 18). Founding entrepreneurs have a tendency towards this management style, especially as it is often necessary in the start-up phase (Bussiek, 1996, p. 41). However, this management style can only be successful, if the leader has a high degree of reputation, maturity, and authority (Rothlauf, 2012). This patriarchal attitude leads to the fact that the employees accept instructions from the "patriarch" without contradiction or reservation and employees tend to be loyal to the company management. Considering the attitude of Generation Y, which questions hierarchies, is skeptical towards authorities and is less loyal to their employer than their predecessor generations, the patriarchal management style is not promising in the long-term. The understanding of leadership must adapt to the new circumstances, otherwise it will be hard to bind employees to the company over a lengthy period. The positive side of this management style is that the company manager usually sees the employees as family members. Although employees are not put above the existence of the company in economically challenging times, they are seen as an important part of the company, and it is therefore seen as important to retain them in the company (Hamel, 2006, p. 237).

In ME, profit maximization is not always as important as in larger companies. In comparison to a hired manager or board of directors the enterprise leader of a micro company also has a private capital interest in the success of the company. They have a long-term (often lifelong) commitment to the company which leads to other objectives of the enterprise guidance. For an owner-entrepreneur, securing the company and independence is more important than increasing the company's profits. An employed managing director attaches more importance to the increase in profits. The reason for this is because salaried managers are often under pressure to increase profits as proof of their performance (Bussiek, 1996).

#### *2.3.1.2 Organizational characteristics*

ME have lean structures and are usually characterized by flat hierarchies and a line management system geared to the entrepreneur (Pfohl, 2006, p. 19). Companies with more employees have more hierarchy levels. Companies with up to 20 employees usually have a management level, companies with 21 to 99 employees have two levels and companies with 100 or more employees have three levels (Sattes & Conrad, 1998, p. 21).

Flat hierarchies enable the company manager to have a clear corporate structure in which they can actively participate in all operational processes and important decisions (M. Winter & Kersten, 2008, p. 226). Flat hierarchies also have the advantage that they facilitate quick decisions through short information paths and direct communication (Pfohl, 2006, p. 19). 19). Compared to large companies, ME have a low degree of formalization, which leads to greater flexibility and allows them to react more quickly to changes (Mugler, 2008, p. 26).

The relationship between management and employees is characterized by informal contact through direct communication as well as instructions and control that are delivered in direct personal contact. Flat hierarchies and direct communication promote job satisfaction among employees, which is often higher than in larger companies (Bergmann & Crespo, 2009a, p. 53). Other strengths that speak in favor of ME as employers are the personal commitment to the company manager and colleagues and the greater involvement of in company decisions (Pfohl, 2006, p. 19). The downside of flat hierarchies is that there are hardly any opportunities for promotion within the company on a vertical level.

#### *2.3.1.3 Personnel structure-related characteristics*

The personnel structure in ME is usually characterized by a small number of employees and they often have a small proportion of unskilled or semi-skilled employees (Pfohl, 2006, p. 20). The majority of all staff are skilled workers, most of whom are trained in their own company (Bussiek, 1996, p. 50). A smaller proportion are academics. For example, the proportion of university graduates in European SME is around 30% (Neubauer, 2011).

Due to the small number of employees, ME have a smaller division of labor than larger companies (Pfohl, 2006, p. 19). This means that some employees take on different functions in the company and perform different tasks. In ME, employees are more likely to play the role of generalists than specialists (Winter & Kersten, 2008, p. 226). A small division of labor has the advantage that no jobs with monotonous work contents are created, which in turn has a positive effect on job satisfaction. However, this also places higher demands on employees in terms of qualification, flexibility and assuming responsibility (Bergmann & Crespo, 2009a, p. 53).

Due to the lean structures, employees are often the only knowledge carriers. When these employees leave the company, functional gaps can arise in important areas that endanger the performance of the company (Bergmann & Crespo, 2009b).

## 2.4 Micro-enterprises and SSBI

Business intelligence has developed into an indispensable decision-making basis in companies. Hardly any large company today works without a BI system. However, due to the implementation effort and the corresponding costs of the complex solutions, these seem to be made only for large companies. The challenges and benefits of SSBI for ME will be described below.

### 2.4.1 Challenges

It has been shown that the importance of analysis tools for companies has risen sharply in recent years. However, studies show that SME in particular have a low degree of implementation of new BI systems. The barriers of SSBI, which ME are confronted with when introducing a new analysis system, are briefly described below.

The scarce time resources of employees, especially management, represent a major challenge while implementing an SSBI. Furthermore, it is not worth hiring BI specialists, especially for micro companies. The responsibility for the SSBI system in micro companies therefore often lies with the managing director, for whom it is often difficult to find the time to deal with "normal" day-to-day business let alone BI and data issues. Furthermore, there are financial barriers due to the capitalization of small and medium-sized enterprises. In addition to the use of manpower, it is above all the implementation costs and the costs for the possible purchase and maintenance of an SSBI software. This is made more difficult by the fact that BI ties up resources and thus creates costs, whereas the benefits cannot be measured directly. As a result, decision-makers are cautious about such investments (Bharati & Chaudhury, 2015).

Personnel is one of the most important areas in the introduction of SSBI, since the quality of data analysis and cooperation depends heavily on the experience and motivation of employees. A lack of acceptance can therefore be a major obstacle. This can have many causes: a high additional effort, a lack of awareness of the topic or a conscious tabooing of certain topics, if negative consequences for the employee follow when analyzing the effectiveness of them. The consequences of this lack of acceptance are a lack of commitment and a lack of willingness to provide information for the business intelligence system (Heneman, Tansky & Camp, 2000). In addition, it is often difficult to adjust psychologically to BI. Psychological barriers such as a false sense of control therefore continue to hamper analysis. People often think they know everything about their daily business. Thus, they often do not see the need for new technologies in the company. Therefore, it is an important challenge to convince people of the importance of the new SSBI system. The right education of employees can help to achieve this. If they see that they do not risk their job and that they can improve the effectiveness of their daily work, they are more willing to accept the changes (Gudmundson, Tower & Hartman, 2003).

### 2.4.2 Benefits

SSBIs offer ME in particular an enormous competitive advantage. For a company without a BI system, developing a report involves enormous effort: lots of numbers must be manually extracted from Excel spreadsheets, accounting systems and other programs, so that they can be saved in a new file. This passes through the hands of different employees. Such an approach not only costs valuable working time, it also carries the risk of transmission errors with serious consequences. If a self-service BI solution is used instead, the data that used to be manually processed is now processed fully automatically, extracted and processed in a table. This reduces the risk considerably of error as well as human resources. Especially in ME, where individual employees are often responsible for several fields of activity, this means a considerable relief (Miller, Bräutigam & Gerlach, 2012).

Thus, the reaction times of the company can be reduced significantly. As soon as a detailed research of company figures is no longer necessary, the time saved can be invested directly into the analysis. How high are the running production and storage costs? Which product currently generates the strongest sales? These questions can be answered without delay using an SSBI system. Only those who know their figures can react quickly and effectively to market developments. This ability to react quickly is particularly important for ME's, as the planning horizon here is generally much shorter than for a large company (Babu, 2012).

With a SSBI system, the company is also always one step ahead in negotiations with suppliers and customers: how high can a major customer's volume discount be? With which supplier can greater savings be achieved? Up-to-date key figures give the ideal basis for best positioning in negotiations (Liautaud & Hammond, 2001).

Another key benefit is that a SSBI solution represents an effective early warning system. Whether it be rising storage costs or falling production costs: if you always keep an eye on the company figures, changes will immediately catch your eye. The analysis goes far beyond the specific daily figures. Thanks to the comprehensive database, meaningful simulations are also available. Thus, threatening slumps in sales or profits are detected at a very early stage and can be prevented or at least mitigated in a targeted manner. For example, well prepared and valid company figures are also an indispensable basis for discussions with banks. Lending is often linked to regular reporting: with the help of the well-founded database, the desired information can not only be compiled quickly and easily, but it can also be converted into meaningful formats such as graphics, dashboards or the like without additional effort. Substantial forecasts create additional confidence (Alexander and others, 2015).

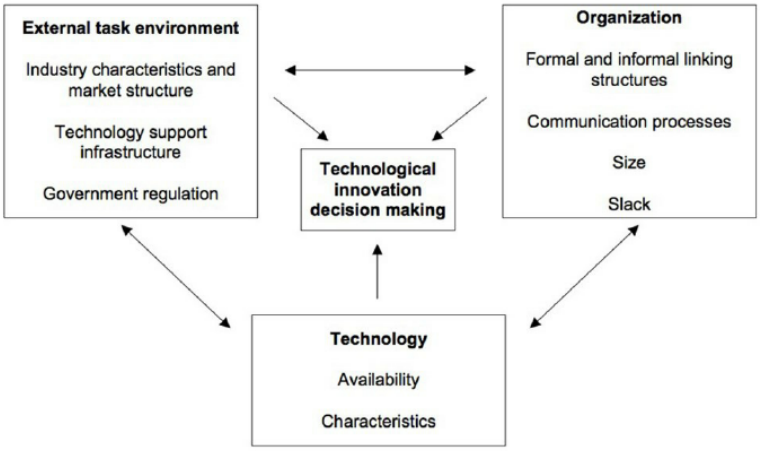
In addition to the aforementioned benefits, it can be said that there are three main benefits that micro companies have through the implementation of an SSBI. The first main benefit

factor is improvements in data support. That includes all attributes that are associated to reporting and its improvement. It includes not only the reduction of the overall effort concerning data analysis and reporting, but it also provides improved report quality as well as allowing a more flexible reaction to new information needs. The second main SSBI benefit factor is improvements in decision support. This covers all attributes that can be associated with decision support and its improvement. Because an SSBI allows the implementation of various data sources, business decisions can be improved through more precise as well more current data analysis. Furthermore, chances and risk analysis for the business will be improved. Thus, a business can react faster to a crisis situation and can also develop new business strategies. The third SSBI benefit factor is *savings*. Through the implementation of an SSBI the company will save financial resources, in personnel and in costs. By saving personnel costs, competitive advantages can be achieved indirectly, either by diminishing the cost part in the income and loss statement or by having the possibility of using the saved resources in other areas (Scholz, Schieder, Kurze, Gluchowski & Boehringer, 2010).

## 2.5 TOE framework

The integration drivers and barriers can be implemented using the TOE framework (Technology, Organization & Environment) according to (Tornatzky, Fleischer & Chakrabarti, 1990, p. 153). This originates from the IS Adoption & Diffusion Research and comprises of three areas from the corporate environment that influence the introduction of technological innovations in a company (see figure 3). These include technological factors (e.g. the internally pre-existing and externally available technological resources), organizational (e.g. size, structure, organizational structure and processes) and factors from the corporate environment (e.g. sector, competition, market structure and regulatory environment) (Martins & Oliveira, 2010, pp. 113–119).

*Figure 3: TOE framework*




*Source: Tornatzky, Fleischer & Chakrabarti (1990).*

The following subchapters are based according to the three dimensions mentioned above, providing a comprehensive overview of the drivers and obstacles identified in the literature.

### 2.5.1 Technology dimension

Technological drivers can be adapted both to the company's internal technological framework conditions and to the externally available technologies (Tornatzky, Fleischer & Chakrabarti, 1990, pp. 153–154). An external technological innovation can be the introduction of an additional communication channel for addressing customers, which leads to complex integration tasks in the company. This includes the definition of new processes or the adaptation of existing ones and responsibilities as well as the implementation of the new system in the existing IT infrastructure (Winter & Aier, 2009, pp. 12–13).

(Chiu, Chen & Chen, 2017) suggests integrating the Diffusion of Innovations (DOI) to find relevant factors of new Innovations in SME. According to the DOI theory, the decision to accept or reject innovation is not a spontaneous reaction, but a social process that extends over a certain period of time and involves a series of actions (Rogers, 2010).

Concrete integration drivers at the technological level include, for example, the replacement of old systems that do not perform well enough, are incompatible or are obsolete for other reasons. Another driver can be the introduction use of new systems, e.g. due to a release or manufacturer change, which involve corresponding integration tasks (Puschmann & Alt, 2004, pp. 109–116).

There are several identifiable factors that influence the adoption of a SSBI at the technological dimension (Hagen, 2007, pp. 68–69). A large number of different applications, databases, etc. can be regarded as a rough indicator of a high degree of heterogeneity and complexity, since these usually require specific interfaces and thus make adaptation and expansion difficult. A large number of such interfaces leads to structural complexity, which can be understood as the number of direct dependencies between different systems. The aim of an integrated system is therefore usually to minimize direct dependencies, e.g. by means of central databases. The temporal heterogeneity describes differences in the introduction times and life cycles of different subsystems. For example, user-oriented front-end systems tend to be replaced more frequently than business-critical backend mainframes, which inevitably leads to integration problems in the long term. Technical heterogeneity is the number of different technologies in a company's IT landscape. With the number of different manufacturers, platforms, programming languages etc. the effort for the operation of corresponding infrastructures increases.

Barriers on this dimension include software tools that are incompatible with other information systems in the company, especially those that provide information. In this case, isolated solutions are quickly created, the cost of maintaining such systems increases and the acceptance of affected employees decreases. Thus, it is important to choose an SSBI system that allow the integration of the various information sources (Yew Wong, 2005).

A new SSBI system must be compatible with the existing systems in the company. Furthermore, the company need to gain a relative advantage from the introduction of the new system. Other drivers that can be added are the trialability and observability of the new SSBI system (Alshamaila, Papagiannidis & Li, 2013). The compatibility can be determined as the most important influencing factor SSBI systems in ME (Zhu, Kraemer & Xu, 2006). Table 7 provides an overview on the drivers and barriers of the technological dimension.

*Table 7: Overview of technological dimension*

| **Technical drivers** | **Technical barriers** |
|---|---|
| Replacement of old systems | Structural complexity |
| Introduction of new systems | Temporal heterogeneity |
| Compatibility to old systems | Technical heterogeneity |
| Relative advantage from new system | Incompatible software tools |
| Low complexity of the new system | |

*Source: Own work.*

### 2.5.2 Organizational dimension

According to Tornatzky and Fleischer, the organizational drivers are primarily based on certain characteristics of a company, including its size, complexity, organizational structure and hierarchical structures (Tornatzky, Fleischer & Chakrabarti, 1990, p. 153). Accordingly, organizational drivers include, in particular, changes to these business structures that require integration of the processes and systems supporting them (Winter & Aier, 2009, p. 12). Winter distinguishes between two characteristics: housekeeping projects usually arise from acute needs or problems and include the elimination of inconsistencies, breaks and redundancies resulting from the large number of individual projects carried out simultaneously. More far-reaching deficits however, lead to consolidation projects that often aim at comprehensive renewals of existing information systems and therefore significantly exceed the scope of housekeeping projects. In this context, the term ‘managed evolution’ is increasingly used to describe the institutionalization of such integration tasks in the form of dedicated organizational and planning structures in order to further develop particularly complex IS landscapes permanently and sustainably (Murer, Worms & Furrer, 2008).

In addition to structural changes, there are other integration drivers at the organizational level, many of which are aimed directly or indirectly at cutting costs or increasing efficiency.

Several studies mention escalating costs or their reduction as the primary driver for integration tasks, which are usually due to high maintenance costs in heterogeneous landscapes. Such problems are often concealed by numerous interfaces and point-to-point connections until, for example, a necessary expansion leads to an explosion in costs (Irani, Themistocleous & Love, 2003, p. 182). The inefficiency and complexity of existing business processes is also often mentioned, resulting in inadequate responsiveness and flexibility. Organizational integration is necessary to enable cross-departmental communication and to coordinate common goals (Hagen, 2007, pp. 68–69).

The integration and standardization of heterogeneous structures is expected to avoid media discontinuities, reduce throughput times, improve collaboration across the enterprise and increase the visibility, timeliness and quality of data and information (Lim, Juster & de Pennington, 1997, p. 342). In addition, the advantages of integrated solutions include the easy maintenance and extensibility, the use of established best practices and the development of uniform user interfaces (Al-Mashari, Al-Mudimigh & Zairi, 2003).

At the organizational level, undefined processes and responsibilities can lead to problems during the introduction of an SSBI. Furthermore, the implementation is limited to simple approaches within individual functions, especially the primary service areas, between which, there is a lack of communication and cooperation. In addition, a lack of methodological knowledge or a lack of implementation of the organization's methodological competence can be attributed. As a result, there is insufficient knowledge of analytical instruments and methodological competence. This reflects above all the low proportion of university graduates. The necessary supply of the SSBI system with relevant information is often insufficient due to the insufficiently developed controlling and planning systems. All these factors can lead to a bad implementation of an SSBI system, which can lead for inefficient and biased analysis results (van de Vrande, de Jong, Vanhaverbeke & de Rochemont, 2009).

A differentiation can be made between the operational organizational unit responsible for the BI systems, and the business user, which is using the SSBI system for analytical purposes. Both sides are closely interwoven: thus technological, organizational and external drivers can be initiated by both sides, but in individual cases it must be differentiated whether the direction of action points to the business side (e.g. in the form of changed business processes) or the IT side (e.g. in the form of new BI systems). These interdependencies can become an obstacle, as the business users in particular usually pursues their own goals. As a result, side effects on the overall architecture are often neglected and only the integration of the new solution is focused on, whereby effects on the integration capability to other systems are neglected (Olszak, Ziemba & Koohang, 2006).

In ME, the senior management plays a particular role. The managing director has such a strong influence in the company that his opinion is transferred to the rest of the organization and thus can favor the use of certain SSBI systems (Chang, Kettinger & Zhang, 2009, p. 6).

Depending on the compatibility of these systems with the existing structures and processes, considerable integration tasks can arise (Irani, Themistocleous & Love, 2003, p. 182). An overview of the drivers and obstacles on the organizational dimension are demonstrated in Table 8.

*Table 8: Overview of the organizational dimension*

| **Organizational drivers** | **Organizational barriers** |
|---|---|
| Change of business structure | Undefined processes |
| Cost reduction | Undefined responsibilities |
| Inefficiency of business processes | Lack of methodical knowledge |
| Complexity of business processes | Insufficient information supply |
| Senior management | Interdependencies between business and IT users |

*Source: Own work.*

### 2.5.3 External task environment

External drivers include various factors from the corporate environment, e.g. certain industry characteristics, the competitive structure, the availability of resources and the regulatory environment (Tornatzky, Fleischer & Chakrabarti, 1990, pp. 153–154). These factors can be described with the term "business dynamics", meaning the frequency of changes in market and competitive conditions - a dynamic market environment demands a correspondingly high degree of flexibility and responsiveness, which in turn requires a high degree of integration (Hagen, 2007, pp. 68–69).

In this context, several contributions refer to the role of institutional factors that contribute to integration in the company (Teo, Wei & Benbasat, 2003, pp. 23–26). As a result, companies are constantly under the influence of external forces in the form of social norms, values and expectations, the fulfilment of which is a necessary prerequisite for lasting competitiveness (Meyer & Rowan, 1977). There are three types of influencing factors:

1. **Mimetic forces** that describe the perceived pressure to imitate the investment decisions and behavior of leading competitors. They occur, for example, when market-leading companies (or the majority of competitors) implement an innovative technology and other companies subsequently feel compelled to imitate this decision. The reasons for this are usually the fear of missing out on technological change, and as a consequence losing touch with competitors in the long term, or the desire to be particularly flexible and innovative (Teo, Wei & Benbasat, 2003, pp. 21–22).

2. **Coercive forces** that can be traced back to those institutions on which a company is directly dependent on. These include strategically important business partners, superordinate groups or regulatory authorities. Entities with sufficient power to dictate conditions to the individual company. In addition to explicitly communicated conditions, this also includes the implicit feeling of pressure to imitate certain behaviors in order not to endanger business relationships. A typical example is the automotive industry, where vehicle manufacturers can exert great power on the numerous smaller suppliers (Webster, 1995).
3. In contrast, **normative forces** occur under the increasing influence of external information, which can come from influential groups such as industry associations, manufacturers' committees, management consultants and specialist publications. The interaction of such factors can have a lasting impact on the opinion of individual companies regarding the importance of certain innovations and thus influence investment decisions (Teo, Wei & Benbasat, 2003, pp. 24–25).

Chang, Kettinger and Zhang (2009) argue that institutional forces are particularly important in the context of integration within the company. This is usually due to the high financial and time expenditures, the far-reaching effects on organizational structures and business processes and the resulting complexity and uncertainty, which can be high inhibition threshold in many companies to carry out larger integration tasks. Against this background, the external forces can make a positive contribution to creating a sense of need for such investments and thus help to overcome obstacles.

As well as competitors, customers are also external drivers. In particular with regard to micro companies, it is becoming increasingly difficult to create transparency in the business operations. However, this transparency is necessary in order to provide customers with reliable information. Such customer needs present companies with challenges that can only be met with integrated SSBI systems, and thus are an important influencing factor for the adoption of an SSBI in micro companies (Markus, 2010, pp. 4–8).

At the external level, some of the problems already mentioned are worsened and others are added. The problem of missing standards in terms of system incompatibilities and data inconsistencies increases when several companies work together. Due to language differences, and diverse cultural differences, as well as different data quality standards and incompatible SSBI tools, the problem worsens when companies from different countries work together. In addition, companies are often unwilling to share their own data with partners, which creates information asymmetries and reduces transparency in the information exchange (Steinheider & Al-Hawamdeh, 2004). Finally, there are differences in information appetite, collection and analysis. The factors listed can be cited as important reasons why the discipline of SSBI in the form of an institutionalized and instrumentalized process has so far been so little developed in ME (Kartiwi & MacGregor, 2007). Table 9 summarizes the main external task drivers and respective barriers:

*Table 9: Overview of external task environment drivers and barriers*

| External Task Drivers | External Task Barriers |
|---|---|
| Mimetic forces | Missing standards |
| Coercive Forces | Unwillingness to share data between competitors |
| Normative Forces | System incompatibilities |
| Customers | Difference in culture and language |
| Institutional forces | Differences in information appetite, collection and analysis |

*Source: Own work.*

# 3 METHODOLOGY & CASE STUDY

## 3.1 Case Study

The practical implementation of a SSBI system in the context of a case study offers the possibility to compare the theoretical results from the literature research with the problems in a real-world environment. The study-relevant steps of the implementation process will be documented in Chapter 4.1

The selected company was ABC Travel & Consulting, which is active in the travel industry, focuses on diving trips in the Caribbean. The company was founded in 1997 under the name Travel ABC and has been under new management since 2016. To expand the business, from just travelling trips to activities such as hotel management and travel consulting the company was rebranded as ABC Travel & Consulting. The company established new tourism products in local markets and wanted to connect different cultural backgrounds. The objective was to generate more travel volume by improving brand awareness (Ruiz, 2018).

ABC Travel & Consulting has one office in Bochum, Germany and one in Augsburg, Germany. The company has six employees, four of whom are based in the Bochum office and the other two in the Augsburg branch. The turnover of the company is less than two million euros. As the company has less than six employees and a turnover of less than two million euros, it can be classified as a ME (Ruiz, 2018).

The tourism industry is a very competitive field of business, and micro companies normally cannot profit from modern BI solutions. The company does not use any analysis tool, they

save all their relevant business data in Excel tables. The goal of the case study is to implement a fully functional SSBI solution for ABC Travel & Consulting (Ruiz, 2018).

After the introduction of the SSBI system, the CEO of the company was interviewed, and based on this interview, a SWOT analysis was then conducted.

## 3.2 Methodology

Case studies in the sense of qualitative empirical social research are a complex and open research approach regarding the choice of data collection methods. Qualitative research methods in general and case studies in particular received increasing support at the international level over the past two decades (Sutton, 1997, p. 98). Outstanding work with decisive impulses for progress and innovation in the economic and social sciences is of qualitative nature (e.g. (Porter, 1991) or (Kaplan & Norton, 1996)). Case studies as a scientific research approach should be distinguished from the colloquial use of the term in the sense of anecdotes, case examples, storytelling or business cases for teaching purposes. According to Yin (2014) they are defined as follows:

"A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident. … The case study inquiry copes with the technically distinctive situation in which there will be many more variables of interest than data points, and as one result relies in multiple sources of evidence, with data needing to converge in a triangulating fashion, and as another result benefits from the prior development of theoretical propositions to guide data collection and analysis" (Yin, 2014).

Case studies are often used in new or particularly complex research fields in order to work out a better picture of the situation, to separate the essential from the insignificant, to abstract and to trace the supposedly new back to the familiar (Stickel-Wolf & Wolf, 2016, p. 189). Compared to quantitative surveys, the strengths of a case study lie in the more comprehensive and thus better representation of social reality. It is not limited to static snapshots (as in quantitative longitudinal or cross-sectional investigations), but makes it possible to trace developments, processes and cause-effect relationships and to make practically relevant, data-based statements (Lamnek & Krell, 2010, p. 299). It captures phenomena in their context, is not restricted in its perceptive ability in contrast to, for example, a quantitatively evaluable questionnaire, and are used innovative areas if quantitative methods still lack the considerable number of cases. However, the aim of case studies is not to generalize statistics and to describe frequencies in relation to the phenomena to be investigated. In contrast to quantitative methods, case studies do not allow a statistical induction conclusion on a population (Kutschker, Bäurle & Schmid, 1997).

Regarding case selection, Yin (2014) distinguishes two types of case studies: the single case study and the comparative case study, in which several cases are examined and compared with each other. The individual case study shows parallels to the individual case experiment and focuses mostly on critical, extreme, unique, representative, typical or previously inaccessible cases or cases that are observed over a longer period of time. For example, individual case studies are conducted to question theoretical findings or to gain new insights into previously unexplored phenomena. In context of this thesis, a single case study of a SSBI system in the ME Travel ABC & Consulting was conducted (Yin, 2014, p. 39).

### 3.2.1 Data Collection

Data collection in the context of case studies is not tied to any particular survey method. However, the selection of the survey methods should primarily depend on the objectives of the study and be appropriate to the research object under investigation in order to collect relevant data to answer the research questions (Kutschker, Bäurle & Schmid, 1997, p. 14). Key methods include questioning, monitoring and content analysis, which are often shared in case study work.

The three basic forms of the survey are the personal interview, the telephone interview and the written survey (questionnaire). With a spectrum from "completely structured" to "little structured, open", different forms of interviews can be located (Diekmann, 2007, p. 374). These include the focused interview, the semi-standardized interview, the expert interview, the problem-oriented interview and the narrative interview (as the level of structuring decreases) (Aghamanoukjan, Buber & Meyer, 2009). Because the aim of the case study is to explore a complex phenomenon that has yet to be explored, open, unstructured interview techniques are expedient. Therefore, the expert interview via telephone was chosen to evaluate the case of SSBI in the company Travel ABC & Consulting.

The expert interview is the middle variant between openness and structuring in data collection (Lamnek & Krell, 2010). In contrast to other variants of qualitative interviews, the expert interview does not focus on the interviewee, but rather on his experiences and interpretations with regard to the research topic. The statements of the expert, who can be regarded as a representative of a certain group, are considered from the outset against the background of his role in the field of investigation (Meuser & Nagel, 2002, p. 453). The function of the expert, which is usually coupled in a responsible position and a privileged access to information about groups of people, organizational processes and decision-making processes, enables the insight into technical and background knowledge as well as into the special experiences that the expert has made in his field of activity. For this case study, the CEO of the company Travel ABC & Consulting, Nicolai Ruiz was chosen. He has relevant insights into the company and is an important decision maker, thus he fulfils the criteria of an Expert in terms of the research goals of this thesis.

An interview-guide was used to structure the process of the expert interview and at the same time provide sufficient flexibility for open discussion (see Appendix 1). This serves for content-orientation of the interviewer, so that all questions that are considered as important are addressed (Bortz & Döring, 2006, p. 135). In order to obtain reliable and undistorted information, it is important to ensure that the survey situation for the interviewee corresponds as closely as possible to an everyday situation (Lamnek & Krell, 2010). The initial phase of the interview has a significant influence on the entire interview process (Bortz & Döring, 2006). For this reason, care should be taken to create a relaxed and collegial-neutral atmosphere at the interview opening. By means of an introductory and narrative-generating question, the interviewee is guided to the question of interest. The structuring of the meaning of social reality is left to the interviewee through a neutral and above all non-directive interview style (Lamnek & Krell, 2010). The interviewee should not appear in his or her remarks nor should judgmental comments be made on what has been said. The interest in the expert's presentations can be made clear by verbal expressions (e.g. "Mhm", "Ah, yes" etc.) or non-verbal gestures (e.g. nodding one's head, eye contact) and the writing down of conversation notes. Any questions from the expert should only be addressed to the extent necessary to avoid distortion in the sense of the social desirability (Schnell, Hill & Esser, 2011). An essential indication of the success of an expert interview is when the curiosity of the expert in the question of the investigation and the interest in an exchange of ideas and the expert unfolds his view of things (Meuser & Nagel, 2002).

The expert interview will be done to get insights about the usage of SSBI in ME on the example of Travel ABC & Consulting. To be able to evaluate the expert interview precisely, the interview will be recorded electronically with the prior consent of the interviewees and then transcribed. The complete transcript together with the handwritten notes form the basis for the subsequent interview evaluation, which will be presented in chapter 4.2.

# 4 CASE STUDY APPROACH

## 4.1 Implementation process of SSBI

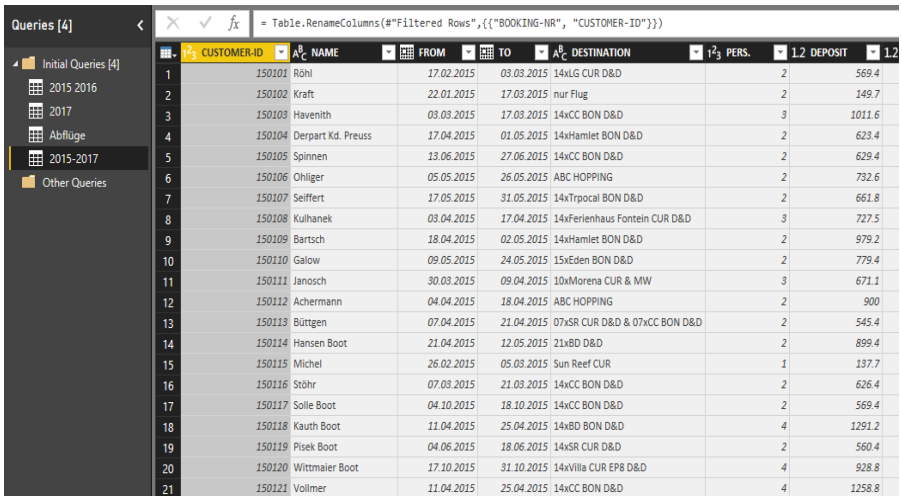
To identify the benefits and barriers of SSBI systems in a ME, a SSBI system with Microsoft PowerBI was installed in the Travel ABC & Consulting company as part of the case study. The following chapter describes the findings due to implementation process. The company has given its daily business of the years 2015 – 2017 for the case study. These are Excel tables contain customer data, sales, destinations and flight data.

### 4.1.1 Data preparation

The data provided by the company were displayed as unstructured data sets, so the data needed to be cleaned before further analyses. This process was performed with the use of the Query Editor of Power BI. Based on the literature concepts described in chapter 1.2.5,

we found that the data provided by the company does not meet the quality criteria because some rows were empty and the data was not consistent (different row headers). Thus, to provides the company a useful SSBI system the data was prepared to fulfil minimum quality parameters (completeness, uniqueness, timeliness, validity, accuracy and consistency). Figure 4 shows the final data set.

*Figure 4: Final data set*




| | CUSTOMER-ID | NAME | FROM | TO | DESTINATION | PERS. | DEPOSIT | 1.2 |
|---|---|---|---|---|---|---|---|---|
| 1 | 150101 | Röhl | 17.02.2015 | 03.03.2015 | 14xLG CUR D&D | 2 | 569.4 | |
| 2 | 150102 | Kraft | 22.01.2015 | 17.03.2015 | nur Flug | 2 | 149.7 | |
| 3 | 150103 | Havenith | 03.03.2015 | 17.03.2015 | 14xCC BON D&D | 3 | 1011.6 | |
| 4 | 150104 | Derpart Kd. Preuss | 17.04.2015 | 01.05.2015 | 14xHamlet BON D&D | 2 | 623.4 | |
| 5 | 150105 | Spinnen | 13.06.2015 | 27.06.2015 | 14xCC BON D&D | 2 | 629.4 | |
| 6 | 150106 | Ohliger | 05.05.2015 | 26.05.2015 | ABC HOPPING | 2 | 732.6 | |
| 7 | 150107 | Seiffert | 17.05.2015 | 31.05.2015 | 14xTrpocal BON D&D | 2 | 661.8 | |
| 8 | 150108 | Kulhanek | 03.04.2015 | 17.04.2015 | 14xFerienhaus Fontein CUR D&D | 3 | 727.5 | |
| 9 | 150109 | Bartsch | 18.04.2015 | 02.05.2015 | 14xHamlet BON D&D | 2 | 979.2 | |
| 10 | 150110 | Galow | 09.05.2015 | 24.05.2015 | 15xEden BON D&D | 2 | 779.4 | |
| 11 | 150111 | Janosch | 30.03.2015 | 09.04.2015 | 10xMorena CUR & MW | 3 | 671.1 | |
| 12 | 150112 | Achermann | 04.04.2015 | 18.04.2015 | ABC HOPPING | 2 | 900 | |
| 13 | 150113 | Büttgen | 07.04.2015 | 21.04.2015 | 07xSR CUR D&D & 07xCC BON D&D | 2 | 545.4 | |
| 14 | 150114 | Hansen Boot | 21.04.2015 | 12.05.2015 | 21xBD D&D | 2 | 899.4 | |
| 15 | 150115 | Michel | 26.02.2015 | 05.03.2015 | Sun Reef CUR | 1 | 137.7 | |
| 16 | 150116 | Stöhr | 07.03.2015 | 21.03.2015 | 14xCC BON D&D | 2 | 626.4 | |
| 17 | 150117 | Solle Boot | 04.10.2015 | 18.10.2015 | 14xCC BON D&D | 2 | 569.4 | |
| 18 | 150118 | Kauth Boot | 11.04.2015 | 25.04.2015 | 14xBD BON D&D | 4 | 1291.2 | |
| 19 | 150119 | Pisek Boot | 04.06.2015 | 18.06.2015 | 14xSR CUR D&D | 2 | 560.4 | |
| 20 | 150120 | Wittmaier Boot | 17.10.2015 | 31.10.2015 | 14xVilla CUR EP8 D&D | 4 | 928.8 | |
| 21 | 150121 | Vollmer | 11.04.2015 | 25.04.2015 | 14xCC BON D&D | 4 | 1258.8 | |

*Source: Own work.*

### 4.1.2 Data model

Although it is possible to implement an SSBI system without a structured data model, it is still suggested to implement one in order to ensure a clear data structure. For this solution it was decided to use the Star Schema as displayed by Figure 5.

The Star Schema includes a fact table and several dimension tables which are arranged in a star-like manner. This schema is read query-oriented and based on exactly one fact table. The fact table contains measurements or results which can be derived from current business and reflect economic performance, such as, for example, profitability, costs, performance / revenue, expenses, expenses, income, etc. The fact table contains foreign keys linking to the dimensions. The dimensions give details about a single fact like who is the customer related to the current booking or what is the dimension. In contrast, the dimension tables contain the "descriptive" data (Kimball & Ross, 2013).

*Figure 5: Star-Schema, Data-Model*

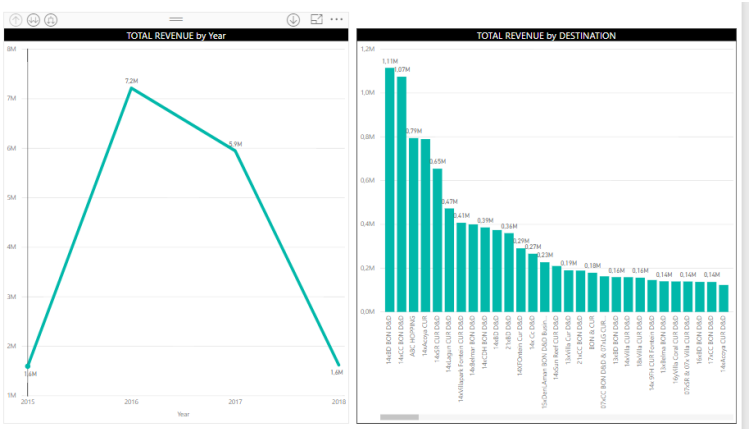

*Source: Own work.*

### 4.1.3 Reports

To generate insights in the business processes of Travel ABC and based on the data model, different interactive reports were created. Figure 6 shows the development of the revenue based on the given data set. This report is interactive which means that when a user clicks on the destination, the analysis changes and shows the revenue just for the location over the last years (see Figure 7). Figure 8 shows an analysis about the destinations with the highest revenue and Figure 9 depicts an analysis of the customer behavior, their destination and the revenue they generated. By this report top customers can be analyzed per year or for a specific period.

These various reports show the power, versatility and practical application of the SSBI system. Decision makers are able to create nicely prepared analysis without any IT knowledge, but just with little training.

*Figure 6: Total Revenue by Year and Destination*

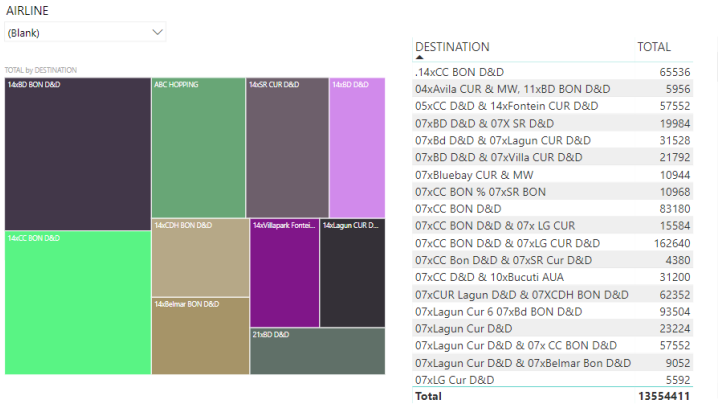



*Source: Own work.*

*Figure 7: Interactive Revenue for selected location*


*Source: Own work.*

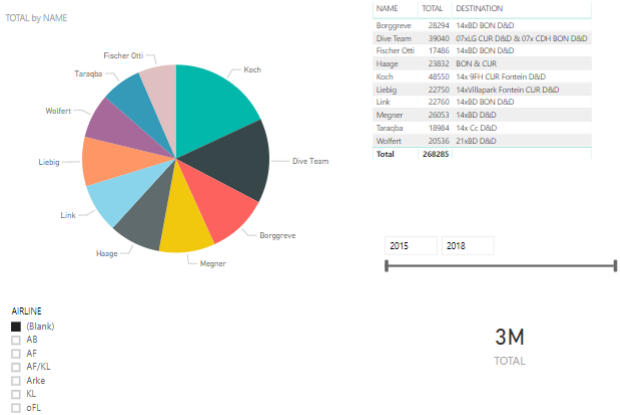
*Figure 8: Top destinations with highest revenue*




| DESTINATION | TOTAL |
|---|---|
| .14xCC BON D&D | 65536 |
| 04xAvila CUR & MW, 11xBD BON D&D | 5956 |
| 05xCC D&D & 14xFontein CUR D&D | 57552 |
| 07xBD D&D & 07X SR D&D | 19984 |
| 07xBd D&D & 07xLagun CUR D&D | 31528 |
| 07xBD D&D & 07xVilla CUR D&D | 21792 |
| 07xBluebay CUR & MW | 10944 |
| 07xCC BON % 07xSR BON | 10968 |
| 07xCC BON D&D | 83180 |
| 07xCC BON D&D & 07x LG CUR | 15584 |
| 07xCC BON D&D & 07xLG CUR D&D | 162640 |
| 07xCC Bon D&D & 07xSR Cur D&D | 4380 |
| 07xCC D&D & 10xBucuti AUA | 31200 |
| 07xCUR Lagun D&D & 07XCDH BON D&D | 62352 |
| 07xLagun Cur 6 07xBd BON D&D | 93504 |
| 07xLagun Cur D&D | 23224 |
| 07xLagun Cur D&D & 07x CC BON D&D | 57552 |
| 07xLagun Cur D&D & 07xBelmar Bon D&D | 9052 |
| 07xLG Cur D&D | 5592 |
| **Total** | **13554411** |

*Source: Own work.*

*Figure 9: Top Customer*




*Source: Own work.*

## 4.2 Results of the Expert interview

The following chapter describes the results of the interview with the CEO of the company Travel ABC & Consulting, Nicolai Ruiz (Appendix 1).

When answering the question about the organizational structure of the company, Ruiz describes the structure as flat, because there is no level of middle management between employees and executives. Although suggestions of the employees are welcome in the company the final decision is always made by the management. Besides, a hierarchy is followed as the opinion of more experienced employees is more valuable. Ruiz also described the management style as modern because the company does not use traditional time sheets as it is more important that employees perform well and generate revenue. The communication between staff and administration can be described as direct via phone or personal meetings for important decisions.

The CEO described the skill set of employees regarding data relevant tasks as mediocre, but that their knowledge has also improved over the last years because these kinds of assignments are becoming more and more important. He also mentioned that some employees, especially the elderly ones, have problems with data relevant tasks.

In response to the question on how the company deals with the phenomena of knowledge carriers, Ruiz answered that the company is aware of this problem. A measure they have in place to prevent damage to the company is employee rotation, so that there will not be a knowledge gap if an employee suddenly decides to leave the company. Furthermore, the executives try to acquire as much expertise in as many areas as possible. The company has no structured knowledge management, so the phenomena of knowledge carriers cannot be ruled out.

In response to the question on whether the employees could profit in their daily business routine from the usage of the SSBI prototype, Ruiz answered that he does not see a lot of additional benefits for employees, but that it could be useful for specific departments such as accounting. Furthermore, he thinks that the management especially could profit from the usage of the SSBI prototype. According to him, it would be especially helpful for strategic decisions and marketing measures. He also thinks that there are enough time resources for SSBI relevant tasks (in terms of training or data preparation) available for normal employees, but it could be difficult to find the time for executives. Regarding the possibility of full implementation of the SSBI prototype into the business routine, Ruiz concerns also include a reasonable balance between cost-benefits.

In answer to the question about whether the company has enough financial resources to invest in an adequate SSBI Structure, the CEO said that they have a fixed budget for technical innovations and they try to renew their systems every three years. However, they do not have the financial scope for investments every year.

In reference to the attitudes of employees towards innovative technologies, Ruiz said that this is generation-dependent and that workers over 40 are especially resistant to innovations. Recently, the company needed to update their Windows systems from XP to Windows 10, and it was a "small drama" for some employees.

In answer to the question about how much the employees know about SSBI relevant tasks, such as data preparation and data quality, Ruiz answered that the level of knowledge is slowly improving because the use of analytical systems is becoming more and more important. However, in general the skillset regarding SSBI relevant tasks is still limited.

Ruiz said that the most valuable statistics to the company are those on customer data, for example average customer expenses and detailed analysis of each customer segment. For him, analytics are important in order of personalized marketing measurements.

When asked whether it is important for the company to react fast to quickly changing markets, the CEO said that their core business is a very old-fashioned market that does not change a lot, but that they are expanding into new markets which are constantly changing. He also mentioned that the institutional framework conditions can change quickly, an example of which being the company recently needing to adapt their system to the new EU data protection regulation. Thus, it is important for the company to react quickly to changing markets. Ruiz thinks that with the usage of the SSBI prototype the employees would be supported in this situation.

In response to the question on how the company negotiates with suppliers, the manager answered that they get a price list from their subcontractors which is negotiable. The bargaining position depends on what kind of revenue Travel ABC can generate. It is therefore important to have the right analytical tools, because with the right data the company would have stronger arguments. Ruiz mentioned that it is difficult to have the actual numbers with their current systems and he thinks that the SSBI prototype could be a solution to this problem: "yes it could definitely help".

With regards to the question about how important it is to have a look at daily figures, the CEO answered that "it is very important". For them it is crucial to measure the performance of employees. Furthermore, daily figures can help to interpret how the business will develop in the future. It is always the goal to increase the revenue and a constant control of the daily figures can help with this. Moreover, daily figures help to control their expenses. In response

to the question about how satisfied he is with their existing analytical tools on a scale of 1 to 10, with 1 not at all, and 10 very satisfied, Ruiz answered with a 4.

The interviewee described the data structure in the company as semi-structured. The data of the employees is systematical, for example they use the same User-IDs. Data referring to customers is not structured at all, for instance, hotel names are not unified or sometimes customer names are written in a different way. Ruiz said that the employees note the data down, but they usually prefer so. In answer to the question "how old the analytical systems are" he informed that the company use Excel 2013 spreadsheets.

When asked about how he feels about the complexity of the SSBI prototype after trying it, Ruiz answered it is "very simple to use and even self- explanatory".

Regarding the question about whether the company has the need to decrease the expenses within the company, Ruiz replied that the company has already existed for 20 years, thus they have old structures and high expenses. So, one of the main objectives for them is to decrease the running costs by trying to introduce more efficient systems and reduce working hours of employees: "It would be perfect if with a new system both could be reached". When asked if this could be reached by implementing the SSBI prototype into daily business the answer was: "yes, definitely".

Ruiz also thinks that the efficiency of their business processes could be improved. The reason for this is that the processes are dependent on specific knowledge that only the management have. Thus, the processes are inefficient because for every decision that is a little bit more complicated employees need to make callbacks with executives. He thinks there is a need for a data management system where the details for each process can be stored and accessed by employees, allowing them to be more self-sufficient.

In reference to the structure of the business processes the manager says that the responsibilities are clearly defined. There are specific things which only specific people have access to and only they can take care of them. The structure and responsibilities of the business processes are not saved in any database, everything gets communicated verbally.

When asked about the information supply in the company, Ruiz answered that he does not see any problems in this field. Even though they have different business locations, they hold daily telephone conferences. Thus, every employee is provided with the information that they need. Furthermore, the staff always have the possibility of callbacks, so nobody is left alone with a task without knowing what to do.

In reply to the question about how far the methodical knowledge in relation to data analysis is developed in the company, Ruiz said it is very low and there is almost no existing methodical knowledge.

Ruiz describe the relationship between IT and business user as complicated. Travel ABC has far more business users than IT users, and the main problem within the company is that the business side often does not understand the technical side. Sometimes technical barriers occur that do not allow a specific feature, and this creates tension within the company because business users cannot see why it is not possible to have this feature.

When asked if the company feels under pressure to imitate the business decisions of leading companies, the manager answered that they do not feel a direct pressure to imitate business decisions. They do not feel the need to implement the same technical systems immediately, but if leading companies introduce specific standards, a micro firm like Travel ABC must meet these standards as well. Thus, they are under pressure to follow leading companies in their business decisions.

In relation to institutions the company is dependent on, there are some companies that they rely on, for example big airlines. If these companies change their requirements, Travel ABC has to meet them.

When asked to what extent external information, such as that from industry associations, influences business decisions regarding the implementation of new systems, Ruiz answered that it is an influencing factor, because they receive new information material almost daily. It is questionable if every suggested system is cost-efficient.

Regarding the influence of institutional forces, the CEO said that they have a very strong influence on business decisions. As a recent example, he mentioned the EU data protection regulation that had a heavy effect on their business. He also said that new laws are made regularly, and if they do not follow these regulations the company can have problems. Ruiz also thinks that institutional forces are an important factor when it comes to the adoption of new systems.

The interviewee also thinks that is very important to customers to get up to date. Travel ABC works in a sector where clients spend a lot of money, so they expect very good service in return. The travel branch is also a sector where confidence is necessary. Ruiz mentioned that it is therefore a key factor to keep the customers updated in order to build trust. If the customer is not informed in time about current events or changes then the relationship is damaged.

Ruiz also said that customer needs are an important influencing factor when it comes to the implementation of new systems. Young people especially expect the company to work with modern IT systems, but older generations also want to have the best service as possible. As an example, he mentioned that a young customer requested that they update their homepage to new standards and show presence on new social media platforms such as Instagram and YouTube.

When asked whether they exchange data with competitors, Ruiz answered with a clear "No, data exchange with our competitors does not happen".

When asked about the cultural differences within the company, the manager answered that there are employees of various different nationalities working there. Everybody speaks English, but sometimes there are communication problems because of cultural differences or language barriers.

In response to being asked about existing standards in their field of business, the CEO answered that there are no general standards that they adhere to. He mentioned that big companies in their sector have some standards but at the same time these standards are not that important, especially for small companies like Travel ABC. He also said that in the future, when the company expands their business, they will probably need to adhere to some patterns.

If there were to be system incompatibilities, he said that that would be a negative decision factor when it came to the implementation of new systems. Ruiz said that the information appetite within the company would be the same, but that different people with different tasks, have different needs for different kind of information.

When asked about the main benefits of SSBI in ME, Ruiz answered that in his opinion they make it possible to quickly acquire detailed statistics about the business. Therefore, based on these analytical reports, well-founded decisions can be made such as marketing and strategical decisions for example. He thinks that SSBI is a good way for ME to get the data that they need, if the system is maintained in the right way.

When it comes to the implementation of an SSBI system, the barriers faced by ME are the necessary financial and time resources. Ruiz says that in a company there are established routines that are difficult to change for the implementation process. The thought that it takes a certain amount of time for the system to become useful/fulfill its potential is discouraging for him.

# 5 ANALYIS AND DISCUSSION

## 5.1 SWOT Analysis

The SWOT analysis (Strengths, Weaknesses, Opportunities and Threats) is a well-established tool to support strategic decision-making. The benefits of a SWOT analyses are achieved on two ways. Firstly, the analysis helps to identify the initial situation regarding the main strengths and weaknesses of the company. On the other hand, further approaches for future projects can be determined by considering the opportunities and threats of the

environment (Gansor, Totok & Stock, 2010, p. 101). The four components of the SWOT matrix can be divided into an external and an internal analysis. The external analysis covers the corporate environment, i.e. an environmental analysis. The O and the T, the Opportunities and the Threats, are exogenous forces. They come from outside, for example through the dynamics of the market. The internal analysis refers to the S and the W, i.e. the Strengths and Weaknesses of the system, which are the subject of self-observation (Bell & Rochford, 2016; Jackson, 2003).

Thus, based on the findings of the literature review and the case study, together with the results obtained in the interview with the CEO of the ABC Travel company, a general SWOT analysis of the potential usage of SSBI in ME was performed. The results are displayed in Table 10.

*Table 10: SWOT Analysis of SSBI*

| | | |
|---|---|---|
| ***Internal Factors*** | **Strengths:**<br>○ Few learning efforts<br>○ Graphically results<br>○ Allows insights into daily business<br>○ Foundation for strategical decisions<br>○ No need for structured data<br>○ No need for advanced technical skills<br>○ No need for traditional BI components<br>○ Cost and time-effective | **Weaknesses:**<br>○ Low data quality<br>○ Basic technical knowledge required<br>○ Danger of useless or low-quality analysis reports<br>○ Danger of wrong reports<br>○ Financial and time resources are needed<br>○ Technical skills are needed<br>○ System incompatibilities |
| ***External Factors*** | **Opportunities:**<br>○ Popularity is rising<br>○ New markets<br>○ Simplification<br>○ Lowering costs<br>○ New products | **Threats:**<br>○ Alternative analysis tools<br>○ Traditional BI systems<br>○ Disillusionment<br>○ Lots of SSBI systems available<br>○ Technology anxiety<br>○ Missing acceptance |

*Source: Own work.*

Regarding the internal factors of SSBI their major strengths are the cost and time effectiveness. Furthermore, decision makers only need basic technical knowledge to get useful results out of the SSBI system and can base their decisions on these data. The SSBI allows users to analyze almost any kind of data. However, this also enhance the risk of entering low-quality data in the system. Thus, the main weaknesses of SSBI are that useless or low-quality analyses reports can be obtained. Moreover, significant financial and time resources are needed to use this system. Also, a basic technical knowledge is required by the user. These factors are especially crucial for ME because they are very limited in their resources (Jasra, Hunjra, Rehman, Azam & Khan, 2011).

Referring to the external factors of SSBI, the major opportunities are the popularity of self-service, and the capacity for simplification. Furthermore, new SSBI products (e.g. mobile apps, web applications) can be created. Besides, is still possible to low the costs of SSBI. Conversely, the biggest threads for SSBI systems are the disillusionment of the users, because, usually, the results are not easily obtained as imagined. The implementation success of new systems are highly deepened on the acceptance of employees, thus missing acceptance and technology anxiety can be important threads for SSBI (Meuter, Ostrom, Bitner & Roundtree, 2003).

## 5.2 Benefits of SSBI in micro-enterprises

Based on the results of the previous chapters, the potential benefits of SSBI in a ME, taking the ABC Travel company as example, are described below. To facilitate interpretation, the results were integrated into the dimensions Technology, Environment, and external Task Environment of the TOE framework.

### 5.2.1 Technology Dimension

An advantage of SSBI is that decision workers do not need substantially training because the system is simple to use. Another benefit is the *low complexity* of the SSBI, that makes it easy to integrate the system into an existing IT structure (Spahn, Kleb, Grimm & Scheidl, 2008). Another advantage for ME is that old-fashioned analytic tools get *replaced* by a modern BI solution. Furthermore, SSBI allows the integration of a range of different types of data, so the *compatibility to old systems* is another benefit. Moreover, ME can gain a relative advantage from the right implementation, because modern SSBI solutions provide sophisticated analysis options (Imhoff & White, 2011).

### 5.2.2 Organizational Dimension

Typically, micro companies have flat hierarchies, that is, the information exchange between management and employees is direct and informal. This is the reason why ME have enough

information, in order to implement SSBI systems (Mugler, 2008, p. 28). As a result, management can obtain *insights into business processes,* which they can use for company's improvements. Nowadays, another drawback for ME is the constant risk of losing important knowledge when specialized employees suddenly leave the company (Bergmann & Crespo, 2009b). Thus, companies can profit from a SSBI in a way that it can function as a *knowledge storage system*, to prevent the phenomena of knowledge carriers. Besides, decision makers and specific departments, such as accounting, can profit from the use of SSBI because it allows them to make well *justified decisions.* Moreover, BI reports are particularly useful for strategic decision and marketing measures (Isik, Jones & Sidorova, 2011). In addition, *valuable statistics on customer data* can be obtained by using SSBI which are especially useful in the daily business of ME. Another advantage of SSBI systems are that they are cheap in comparison to traditional BI systems (i.e. *low acquisition and maintenance costs*) (Humphries, 2017) which also allow ME to lower *their costs*, through the improvement of the analyzes. Moreover, inefficient business processes are a driver for the implementation of new systems, so with SSBI the *efficiency of business processes can be improved,* because it provides the right analyses reports and allows employees to work in a more self-sufficient way. A ME that uses a SSBI can have a look on daily figures and therefore is able to *analyze the performance of their employees*, *control their expenses* and to *improve their business on a regular basis* (Imhoff & White, 2011).

### 5.2.3 External Task Environment

*Mimetic* forces are an important external task driver when it comes to the implementation of SSBI in ME (Teo, Wei & Benbasat, 2003, pp. 21–22). If leading companies introduce specific standards in the sector, smaller companies also have to meet to these standards. This also applies to requirements triggered by *coercive*, *normative* and *institutional* forces (Webster, 1995, pp. 31–41). Therefore, by implementing a SSBI, ME profit in the way that they *meet condition of the forces*, mentioned in the TOE framework. For example, a SSBI can guide ME to meet governmental regulations (Chang, Kettinger & Zhang, 2009). With SSBI systems, companies can address customers in a personalized way, thus another benefit is improved *customer satisfaction*. Through the increased customer satisfaction another benefit is that *new customers get won* and *customer segments increase* through the right usage of SSBI. Moreover, with SSBI, it is possible to quickly react to fast changing markets and framework conditions which allow ME to flexible *react* in such markets, thus a *competitive advantage* for ME, is achieved (Miller, Bräutigam & Gerlach, 2012). Furthermore, a ME that uses an analytical data provided by SSBI have a *stronger bargaining position when dealing with supplier,* because companies can underpin their arguments with data (Liautaud & Hammond, 2001).

## 5.3 Barriers of SSBI in Micro-Enterprises

Based on the results of the previous chapters, the barriers of SSBI in a ME, taking the ABC Travel company as example, are described below. To facilitate interpretation, the results were integrated into the dimensions Technology, Environment, and external Task Environment of the TOE framework.

### 5.3.1 Technology Dimension

A big barrier towards the adoption of SSBI in ME is the *low skill of employees regarding data relevant tasks*. This is especially true for older employees. The quality of the reports generated by the BI system is highly dependent on high quality data and the right adoption of them into the SSBI system (Yeoh & Koronios, 2010). The *lack of technical knowledge* is another barrier. *System incompatibilities* increase the complexity of the implementation process. ME often don't have a data management (Yew Wong, 2005). Thus, the data is usually stored in a chaotic form and the high prevalence of missing data management leads to *low quality data* and *structural heterogeneity* which are important barriers for implementing SSBI in ME (Hagen, 2007, pp. 68–69).

### 5.3.2 Organizational Dimension

The company of the case study, Travel ABC & Consulting has as a flat organizational structure, without a middle management. The executives decided alone if a new SSBI system would be implemented. Based on the findings of chapter 2.3.1.1 and chapter 4 it can be said that a *patriarchal leadership* style is typical for ME (M. Winter & Kersten, 2008, p. 226). Thus, this leader style is a barrier for the implementation of SSBI in ME. Furthermore, the results of the thesis show that *casual employees do not profit* from a SSBI. Casual employees in ME, normally have enough time for SSBI relevant tasks, therefore, the lack of time for SSBI relevant tasks in ME are not a barrier, but the time schedule of executives is very tight. Thus, *missing time resources of executives* can be added to the barriers (Bharati & Chaudhury, 2015). Older employees in particular are skeptical about innovations. Employee acceptance, however, is critical for the success of an SSBI, so *lack of acceptance* is another barrier (Heneman, Tansky & Camp, 2000). In the literature review it was mentioned that undefined responsibilities and processes are barriers for the implementation of SSBI. However, according to the findings of the expert interview, it can be ascertained that ME do not face these problems because they have only a limited number of employees and processes. The findings also show that distinct *methodological knowledge is not available* in ME, but it is important for the correct implementation of SSBI in a company, thus it can be another hurdle (van de Vrande, de Jong, Vanhaverbeke & de Rochemont, 2009). Business users have often problems to communicate clearly with IT users, and the other way around, so the finding that *interdependencies between business* and IT users are a barrier in ME can be confirmed (Olszak, Ziemba & Alex Koohang, 2006).

### 5.3.3 External Task Environment

In the literature review, it was found that differences in information appetite, collection and analysis are a barrier when it comes to the implementation of SSBI. However, this was not confirmed by the findings of chapter 4. ME have only a small number of employees and communications paths are direct (Bergmann & Crespo, 2009b). On the other hand, SSBI is heavily dependent on extensive data exchange, which are usually not performed by ME with their competitors. So, *unwillingness to share data between competitors* can be determined as big barrier for SSBI in ME. Another barrier are the *cultural differences* within the company, that can lead to misunderstanding between individuals and hampers SSBI implementation (Steinheider & Al-Hawamdeh, 2004). Finally, only few standards in the sector where the company Travel ABC operates exist. Thus, *missing standards* are another drawback for the implementation of SSBI in this sector (Kartiwi & MacGregor, 2007).

## 5.4 Limitations and Future Research Direction

Even if the present work reaches a meaningful qualitative depth, the results are subject to limitations because they are based in a single case study. Since the business field of Travel ABC is in the travel industry, our results may be limited to experiences from the travel sector. To address these limitations, we recommend further case studies with different branches industries to be performed.

Another limitation is that only one expert was interviewed in the context of this thesis. Although the interviewee was the CEO of the company and had sufficient knowledge about the topic we propose as future research that other experts with different professional backgrounds are interviewed to obtain diversified results.

The prototype developed for the company in the case study is based on Microsoft PowerBI. However, there are a number of other programs with which self-service analyses can be performed. The research results do not clarify conclusively whether other SSBI programs may be subject to other advantages and barriers. For future research, we suggest the evaluation of other SSBI solutions, which can lead to different results.

# CONCLUSION

The objective of this thesis was to provide an overview about advantages and barriers of SSBI in ME. The results are based on a broad literature review and on the findings of a case study performed with Travel ABC & Consulting, a ME from the tourism and travel business. Furthermore, a prototype of an SSBI system was able to be implemented in this company. Based on the research results together with the main aspects discussed during an interview with the CEO, a SWOT analysis was performed. Finally, we were able to identify the initial

situation regarding strengths and weaknesses of the company and suggest future approaches considering the opportunities and threats of the environment in this field.

The use of BIS for the supply of information management has long been part of the standard repertoire of big companies. The adaptation of the self-service concept into BI has enable for the first time ME to profit from sophisticated data analysis tools. SSBI have been included in the offerings of many of the world's leading software manufacturers, the most prominent example is the software suite PowerBI from Microsoft, that was used in our case study.

Although more data is currently available, and further applications are covered and functions are included in the solutions, improvement in the implementation and use of SSBI systems are still needed. However, technical features are not the main barriers of SSBI in ME. In order to achieve sustainable competitive advantages with BI, considerable subject-specific and organizational requirements must be mastered. It requires a strategy-driven, coordinated and systematic approach with well-established best practices.

In the current scenario, SSBI solutions are expected to spread among micro-sized enterprises, mostly because the system can provide faster and more detailed results, which are paramount to companies to react to market changes or to act better in short periods of time. Simple office applications as they are used in many ME today, will no longer be sufficient as BI solutions in the future.

SSBI is a useful tool for decision makers in ME. These systems convert the constantly increasing amounts of data into useful information. BI reports support daily work and provide the basis for strategic decisions. Furthermore, it is possible to analyze the current situation of the company. This can streamline business processes, improve customer and partner relationships, reduce costs, minimize risks and optimize processes. ME, which master the use of SSBI, will gain a significant competitive advantage.

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# APPENDIXES

**Appendix 1:** Interview Guidelines

**Can you please describe the style of leadership in your company?**
This question is regarding chapter 2.3.1.1 to determine if the micro company specific leadership style can be a barrier for the introduction of a SSBI.

**How is the hierarchy structure in your company?**
ME are generally characterized by flat hierarchies (see chapter 2.3.1.2). If this is the case, decision makers could benefit from the usage of a SSBI to get insights in all processes of the company. Furthermore, other employees can benefit from the insights generated from the SSBI because there is not a high level of hierarchy.

**How is the communication between employees and the management of the company?**
A BI system is highly dependent on actual data, and the more data the employees provide the better the analysis will be. Thus, employees should provide enough information/data for a useful analysis. So, if the communication is characterized through flat hierarchies and informal contact (see chapter 2.3.1.2), the company will benefit from good analysis. If this is not the case, another barrier for the implementation of this type of system would occur.

**How would you describe the skill level of your employees regarding data relevant tasks?**
Chapter 2.3.1.3 describes that ME's mostly have skilled employees trained in their company. So, it is questionable if the employees have enough knowledge to produce data from good quality. Thus, if the skill level regarding data is low, another barrier for the implementation of a SSBI may exist.

**How does your company copes with the phenomena of knowledge carriers?**
ME's employees are often the only knowledge carriers, so if they leave the company functional gaps can arise that endanger the company's performance. So, if the company would have knowledge carriers, the implementation of SSBI may benefit the company because it allows the archiving of knowledge. (chapter 2.3.1.3.)

**Do your employees benefiting in their daily routine from the usage of the SSBI Prototype system?**
**If yes, are time resources available for SSBI relevant tasks (in terms of training, data preparation) for the employees.**
Employees must profit in their daily routine from the usage of the SSBI system. First, is important to recognize if this is the case for the provided solution. If so, the scare time resources of employees can be a major challenge while implementing a SSBI system (see chapter 2.4.1). Thus, if the employees do not really have time for data preparation or other tasks regarding SSBI, that would be another barrier.
**Does the management of the company have time for SSBI relevant task?**

The managements of MEs are especially useful due to their capacity, and they are often the only decision makers. However, they need to invest time to get used to the SSBI, which can represent another barrier to implement the system (chapter 2.4.1).

**Do you have enough financial resources in the company to invest in a SSBI structure for your company?**
The financial costs of SSBI are significant lower than for traditional BI systems, but still financial resources can be a major barrier when it comes to the implementation of an SSBI in ME's (see chapter 2.4.1).

**How would you describe the attitude of your employees to new technologies?**
The introduction of SSBI also depends on one important component of the company: the personnel. When employees are generally open to new technologies and accept the introduction of other systems,
it can be assumed they are more likely to change their workflow with the usage of a SSBI system. However, a lack of acceptance can therefore be a major obstacle, see chapter 2.4.1.

**How much do the employees know about SSBI relevant task like data preparation and data quality?**
Since the quality of data analysis and cooperation depends heavily on the experience and motivation of employees, this question is important. If they have already some knowledge about data preparation it would be a benefitable factor for the implementation of the SSBI A lack of this knowledge would lead to another barrier because the employees would need training in terms of data preparation and data quality. Otherwise, without the relevant training biased reports could be generated.

**What kind of data analysis would help you in your daily business routine?**
With a SSBI, various data and business reports can be created, depending on the requests of the decision maker and the company needs (chapter 2.4.2).

**Is it important for your company to react fast to quickly changing markets?**
**If yes, do you think that your employees would be to respond quickly to these requirements in terms of data analysis or creating suitable reports with the usage of the SSBI prototype?**
How high are the running production and storage costs? Which product currently generates the strongest sales? These questions can be answered without delay using a SSBI system. Only those who know their figures can react quickly and effectively to market developments. What is the purpose of the decision-making system for the organization? If this is critical for the company, a SSBI can represent an important gain (chapter 2.4.2). Therefore, the question after is to double check if this benefit can be reached with the usage of the SSBI system.
**How do you negotiate with suppliers?**

With a SSBI system, the company is also always one step ahead in negotiations with suppliers and customers: up-to-date key figures give the ideal basis for best positioning in negotiations. So, this question is aimed to identify if the ME uses up-to-date key figures for negating with suppliers, which could be another benefit for MEs (chapter 2.4.2).

**How important is it for you to have a look on daily figures?**
Through the control and simulation of business figures, the SSBI can function as an early warning system which can also be favorable to the company (chapter 2.4.2).

**How satisfied are you with your existing analytic tools on a scale 1 to 10 (with 1 not at all, and 10 very satisfied)?**
If the company is satisfied with the analysis tool they have now, there is no need for more sophisticated tools. However, more negative answers may reveal the need for the implementation of different systems (covers technical drivers).

**How is the data structed in your company? For example, do you use different User IDs for logins?**
If the company uses different types of data, this means that they have a structural complexity in the company, which make it difficult to include data into the SSBI. This can represent another barrier for the implementation of SSBI in a ME (see chapter 3.1.1).

**How old are the different applications/systems you use in the company?**
If the systems are old, it can be a big effort to replace them with a new technology, which can be a barrier for the company. However, this can also be an opportunity for the company to benefit from a new system. For instance, Travel ABC uses Excel, but its replacement for a SSBI can offer much more benefits. This also covers the factor compatibility, because it is possible to confirm if older data sources can be implemented in the system (see table 8 of chapter 3.1.1).

**Can you please describe how do you feel about the complexity of the SSBI prototype after trying it?**
The complexity of usage of the new SSBI system can be a barrier, but the opposite may represent a great gain for the company as an important technical driver.

**Do you have the need to decrease existing costs?**
The reduction of costs in a company is important as observed in the organizational driver from the TOE framework. The implementation of a SSBI can indeed be cost-beneficial to a ME (chapter 3.1.2).

**Do you think there is space for improving the efficiency of the business processes of your company? (yes/no)**

Inefficient business process is a driver for the implementation of new technologies in a company. Like described before in chapter 2.3, ME often has unstructured processes. So, if this is the case, the implementation of a SSBI would be another benefit for ME's to enhance the efficiency of their business processes (chapter 3.1.2).

**Can you tell me about how your business processes are structed?**
(Are they defined? Are the responsibilities clearly defined for business problems?)

**How are your processes in the company defined?**
Are the business processes being clearly defined in the company? Without this, the implementation of SSBI can be hampered. However, through the implementation of a SSBI, the definition of processes and responsibilities are mandatory, which can also indirectly benefit the ME. (chapter 3.1.2).

**How is the information supply in the company?**
Since a SSBI is dependent of a well-defined information supply, the lack or issues in this process are barriers for the implementation of the system in a ME. However, if this barrier is overcome, the improved information supply will be a benefit for the company (chapter 3.1.2).

**How far is the methodical knowledge developed in relation to data analysis?**
To gain a meaningful analysis through the implementation of a SSBI, a minimum of a methodical knowledge need to exist in the company, otherwise this can represent a barrier. Through the implementation of SSBI and the introduction of a data governance framework, the necessary methodical knowledge will be developed, which may finally benefit the company.

**How is the relationship between IT and Business users?**
Probably the company does not even have IT or BI users, because MEs are limited in their financial resources. However, usually the relationship between these users is a big obstacle for the implementation of a SSBI (chapter 3.1.2).

**Does your company perceives pressure to imitate the business decisions of leading companies in your sector?**
This question aimed to identify mimetic forces driving business decisions when it comes to the implementation of new technologies.

**Can you tell me more about the nature of the relationship with those institutions your company is directly dependent on? For example, do they ask specific kind of analytic data?**
Are there coesive forces that drive or prevent the implementation of SSBI in ME? If the answer was not clear, more specific questions would be asked.

**How does external information, such from industry associations influence your business decision regarding of the implementation of new IT systems?**
This question aimed to find out if there are normative forces that influence the adoption of new technologies such as SSBI.

**How would you say that institutional forces influence your business decisions?**
Institutional forces are particularly important in the context of integration within the company, so it could be an important driver or also a barrier.

**How important is it for your customers to get actual information?**
The company is active in the travel branch, so it is important to deliver the customer actual information about delaying flights or changes in the travel in general. Through the SSBI the customer can be provided with actual information, which can also be a gain for ME (chapter 3.1.3).

**How does the customer influence your business decision?**
The customer can be an important external task driver, so this question aimed to reveal if the company shape business decisions regarding the implementation of new technologies.

**Do you share data with your competitors?**
To analyze the competitors, the SSBI is dependent on external information. If the company is unwilling to share data, this can be another barrier (chapter 3.1.3).

**How many different nationalities work in your company?**
If a big diversity among employee's languages exist, this can be a barrier for the company (e.g. if the decision maker does only speak English but has to work with data in German). (chapter 3.1.3).

**Can you tell me a little bit about the cultural diversity in your company?**
If significant differences between cultures and languages exist inside the company, it can be difficult to implement a SSBI.

**Can you tell me something about standards in your field of business?**
According to the TOE framework (see chapter 2.5), missing standards are a big barrier for the implementation of SSBI in ME.

**How would you say influence system incompatibles your decision regarding new technologies?**
System incompatibles are an external task barrier according to the TOE framework

**How would you describe the information appetite in your company? (Is it for everybody the same or is it different?).**

This is also an external task barrier according to the TOE framework.

**What are in your opinion are benefits for the adoption of SSBI systems in ME?**

**What are in your opinion are barriers of the adoption of SSBI systems in ME?**